The NEBB Professional

December, 2010

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GovEnergy Update

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ASHRAE Standard 90.1 and Leakage

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On The Inside

The NEBB Professional

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Happy Birthday, NEBB!!

More than 400 NEBB Certified Professionals, industry leaders, vendors and guests came together in Bonita Springs, Florida for the 2010 NEBB Annual Conference and to celebrate the 40th Anniversary of NEBB.

This year's Annual Conference featured two days of technical sessions, a record setting vendor participation, and social activities—including the 13th Annual Golf Tournament and the 1st Annual Fishing Tournament.

According to Steve Wiggins, NEBB President, 2010, "NEBB is the great association that it is today because of the past 40 years of impeccable integrity that is the legacy of those gone before us."

Throughout the week, attendees grew their knowledge base, networked and celebrated a year well done!

President Wiggins said in closing, "In these times of uncertainty it is great to see how much NEBB Certified Professionals value the annual convention. For the convention this year to be the largest conference that we have ever had is tremendous. We were especially blessed by the attendance of so many of industry friends."

See you in Savannah, October 19-21, 2011!!

GovEnergy 2010 Workshop and Trade Show

This year's GovEnergy workshop and trade show took place August 15-18, at the Dallas Convention Center. The event attracted 4,100 participants and featured 273 trade show exhibits. This was the largest workshop and trade show in GovEnergy's thirteen year history. Attendees included federal policy makers, federal facility and energy managers, and federal procurement and contracting experts. GovEnergy also drew participation from utility companies, energy service companies, and equipment manufacturers. GovEnergy is an annual training event that helps federal employees meet their energy management goals. Promoting this year's theme, *Blazin' Trails to Energy Solutions!*, it featured speakers representing the public and private sectors, professional development and education credits, and multiple networking opportunities. Several attendees also chose to participate in a variety of local facility tours that were held on Sunday, prior to Monday's opening session. The tours demonstrated energy-saving technologies used throughout the Dallas metro region.

"Under the President's leadership, federal agencies are aggressively working to reduce the green house emissions of their operations. Investing in energy efficiency and renewable energy technologies represents the most cost effective way for agencies to meet their aggressive requirements for green house gas reductions," said David McAndrew, the 2010 GovEnergy Chairman. Added McAndrew, "GovEnergy represents the best single opportunity for federal energy management teams to receive the training and information they need to meet these important requirements. GovEnergy is a must-attend event for the federal energy management community, it is where Feds and their industry partners go to learn about new technologies, share best practices, and make the connections they need to keep the government leading by example in energy and water efficiency, and renewable energy use."

The event was sponsored by seven federal agencies: the Department of Energy's Federal Energy Management Program (DOE-FEMP), the General Services Administration (GSA), the Department of Veterans Affairs (VA), the Department of Defense (DOD), the Department of Homeland Security (DHS), the Department of Agriculture (USDA), and the Environmental Protection Agency (EPA).

NEBB was on site to provide the pre-event training session, *The Top Ten Things You Need To Know About Retro-Commissioning Your Facility*. Presented by Steve Wiggins on the Sunday prior to GovEnergy, the session offered an overview of what facility managers should know when preparing for the retro-commissioning process. Attendees were given a CD of NEBB's commissioning and retro-commissioning standards and specifications. The NEBB *Professional* provided additional support by serving as one of the event's media partners.

Planning is currently underway for GovEnergy 2011, which will be held August 7-10, at Cincinnati's Duke Energy Convention Center. Additional information about this event may be found at www.GovEnergy.gov.

Getting Data You Need With Particle Measurements

Particles, large and small, are an important factor in maintaining good indoor air quality. Control measures, such as improved housekeeping, upgraded filters, or proper exhaust design, are usually straightforward actions. However, choosing the proper control depends on having the correct data for decision-making. Many instruments, employing various technologies, are currently available to provide this real time information. The question is "Which technology is right for my application?"

Photometers, optical particle counters (OPCs) and condensation particle counters (CPCs) all measure airborne particles in real time. Each technology has a unique sensitivity to specific particle characteristics such as size, mass and refractive index. Table 1 summarizes the basic performance differences. Note in particular the size range for each and the upper limit of the number concentrations between OPCs and CPCs. Table 2 summarizes typical applications for each measurement technology.

TABLE 1. Comparison Chart—Real Time Particle Measurement Technologies

	Photometer	OPC	CPC
Typical Size Range	0.1 to 10 µm	0.3 to 20 µm	0.02 to 1.0 µm
Measures Particle Mass	Yes	No	No
Measures Particle Size	No	Yes	No
Detects Single Particles	No	Yes	Yes
Typical Mass Concentration Range	0.01 to 100 mg/m^3	N/A	N/A
Typical Number Concentration, Upper Limit	N/A	2×10^6 Particles/ft^3 70 Particles/cm^3	1.5×10^{10} Particles/ft^3 500,000 Particles/cm^3

TABLE 2. Comparison Chart—Applications (Accepted Best Practice)

	Photometer	OPC	CPC
Indoor Air Quality - Conventional studies	Good	Good	Excellent
Indoor Air Quality - Ultrafine particle tracking	Poor	N/A	Excellent
Industrial Workplace Monitoring	Excellent	Poor	Excellent[1]
Outdoor Environmental Monitoring	Good	Good	Excellent[1]
Emissions Monitoring	Excellent	Poor	Good
Respirator Fit Testing	Excellent	Poor	Excellent
Filter Testing	Excellent	Excellent	Excellent
Clean Room Monitoring	Poor	Excellent	Excellent

[1] Health effects of ultrafine particles (below 0.1 µm) are not completely understood, though research suggests that they may cause the greatest harm. There are currently no established exposure limits or governmental regulations specifically addressing ultrafines.

Photometers

Often used for industrial workplace studies and emissions monitoring, photometers are well-suited for assessing human exposure to specific size fraction aerosols in real time. They use conventional light-scattering technology to closely estimate particulate mass concentrations.

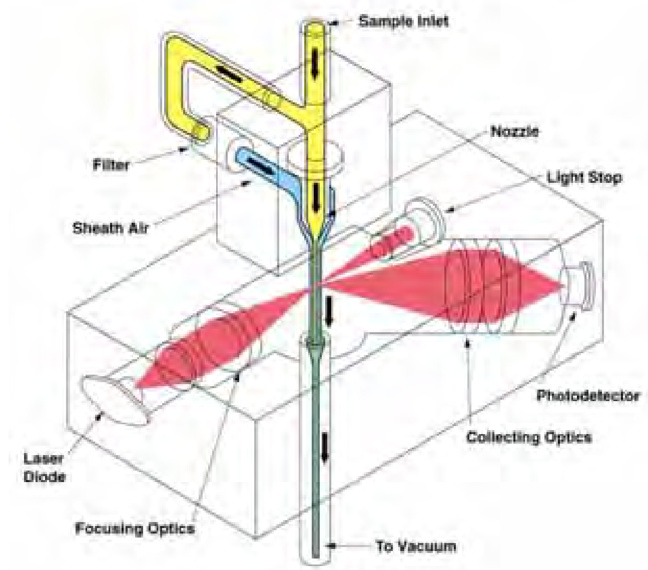

Figure 1
Flow Through a Photometer

The scattered light depends on the size distribution of the aerosol, refractive index, shape factor and density of the aerosol. During calibration, the light scattering response of the calibration aerosol to the laser light in terms of voltage across the photo detector is related to the density of the aerosol in terms of mass. The size distribution of the aerosol also affects the instrument's response. Light scattering-type aerosol monitors respond linearly to the aerosol mass concentration. That is, for a monodisperse aerosol, one particle scatters a fixed amount of light; two particles scatter twice as much light; and 10 particles scatter 10 times as much light.

The operation of a typical photometer is shown in Figure 1. A sample is drawn into the instrument by a continuously running pump. The size fraction of interest is aerodynamically "cut" from the air stream at the sample inlet using either an impactor or a cyclone. The size fractions of most interest are respirable, thoracic, PM_{10}, $PM_{2.5}$ and $PM_{1.0}$.

The size-classified sample passes through a focusing nozzle and enters the photodetector sensing chamber. A laser diode emits light through a set of focusing optics. As light contacts the sample particles, it is scattered in all directions. A photodetector converts this light into a voltage, which is calibrated against a known aerosol mass concentration (mg/m^3). In some instruments, a portion of the sample is drawn from the main air stream, filtered and re-introduced as sheath air. The sheath air surrounds the particle sample to protect the instrument's optics from fouling.

Photometers typically measure particle size ranges from 0.1 to 10 µm diameter with concentrations ranging from 0.01 to 100 mg/m^3 or more. Photometers cannot "see" particles below 0.1 µm (ultrafine particles) because the particles are too small to scatter detectable quantities of light. Photometers measure the aggregate signal from a "cloud" of particles and are not designed to detect individual particles, even when they are relatively large.

Most photometers are calibrated against a standard test dust, commonly referred to as Arizona Road Dust. This calibration is a good approximation for most ambient aerosols. Because optical measurements are dependent upon particle size and material properties, there may be times in which a custom calibration would improve the accuracy for a specific aerosol.

Optical Particle Counters

Optical particle counters measure particle size and number concentration by detecting the light scattered from individual particles. They were traditionally used for clean room monitoring, but have more recently found application in filter testing, outdoor environmental monitoring, and indoor air quality studies.

Single particles are drawn through a focused laser beam and produce a flash of light, as illustrated in Figure 2. The intensity of the scattered light is a complex function of the diameter, shape and refractive index of the particle as well as light wavelength and geometry of the optical detector. A photodetector measures the amount of light that each particle scatters and records a count for each calibrated size range or bin.

The measured size range is typically 0.3 to 20 µm diameter, and the number concentration is limited to a maximum of 2,000,000 particles/ft^3 (70 particles/cm^3). OPCs are calibrated with perfectly uniform, spherical polystyrene latex bead particles of known refractive index. The measured size of an unknown particle is therefore the "light-scattering equivalent size" as compared to the known calibration particle. The actual physical size may be quite different from this.

There are several variables involved with selecting the optimum particle counter for various applications.

- **Resolution**—the smallest particle size difference that can be detected.
- **Sensitivity**—the smallest particle that can be "seen" at a particular counting efficiency point.
- **Counting Efficiency**—the particle concentration that can be "seen" by an instrument against the true particle concentration as measured by a more sophisticated or calibration quality means.
- **Precision**—the standard deviation of measurements of the same sized particles.
- **Repeatability**—the extent to which an instrument will give the same response in size and count to controlled or known airborne particle conditions over time.

To keep instruments reasonably portable, most optical particle counters have a lower limit range of about 0.3 microns. This is due to the intensity of the laser light source in a limited size configuration. Instruments typically count in two to six size ranges or "bins" in near real-time. Most are battery operated with an option to run off AC power with an electrical adapter. Costs range from a few thousand dollars for handheld units to tens of thousands of dollars for sophisticated laboratory grade instruments. Manufacturers typically recommend annual calibration for reliable operation.

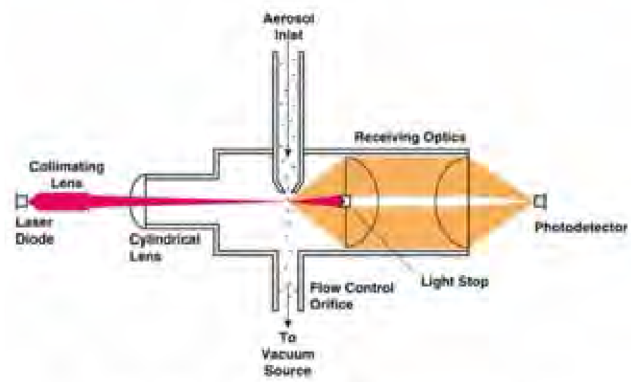

Figure 2
Flow Through an Optical Particle Counter

High flow counters, typically 1 cfm or 28.3 L/min offer advantages in certain situations. There are even some 2 cfm (nominal) or 50 L/min units on the market. The high flow rate instruments are for conditions where a large volume of air needs to be analyzed. Usually the particle size resolution is reduced and the ability to detect small particles is reduced due to a decreased signal to noise ratio. These units, though considered portable, tend to be somewhat bulkier and heavier to accommodate the larger volume pump and batteries to support operation.

Low flow counters, typically 0.1 cfm or 2.83 L/min offer clear advantages where less air volume is needed such as in spot checks. The lower flow rate allows for smaller particles to be detected as they are in the viewing window longer. This also allows for higher concentrations to be measured. Many of these low flow instruments are handheld, lightweight and battery operated.

Applications where particle size and count are needed include:

- Aerosol research
- Industrial hygiene
- Personal exposure monitoring
- Indoor air quality assessment
- Environmental studies such as EPA compliance
- Verifying removal efficiency in filters or air cleaners

- Process concentration fluctuation
- Particle source identification
- Yield improvement in precision manufacturing processes
- Verifying equipment performance as in building management
- Meeting specification such as air filter ratings
- Meeting regulations or certification as with cleanrooms, safety cabinets, fume hoods or in pharmaceutical preparation
- Quality assurance
- Clearance verification such as HVAC system cleaning
- Verifying environmental controls such as paint booth exhaust
- Monitoring particle migration from construction or remodeling

Selecting the optimum particle counter for a given application depends on the importance of these situational conditions. A person may choose ruggedness and long term repeatability over precision when doing environmental studies, for example. Another person may elect sensitivity and efficiency in a highly sensitive semiconductor manufacturing area where even slight fluctuations in ambient conditions may greatly impact quality and yield.

Condensation Particle Counters (a.k.a. Ultrafine Particle Counters)

Condensation particle counters, sometimes referred to as condensation nuclei counters or ultrafine particle counters, are specialized instruments that first enlarge very small particles to an optically detectable size. They excel at counting particles in size ranges that are invisible to OPCs and photometers. These measurements are made in units of particles per cubic centimeter (pt/cm^3) versus traditional aerosol measurements of milligrams per cubic meter (mg/m^3) made by photometers. CPC's can see single ultrafine particles, making it far more sensitive than other technologies.

CPCs are used for a variety of applications ranging from respirator fit testing to environmental air pollution studies to basic research. They are particularly well-suited for tracking indoor pollutants to their source since particles less than 0.1 µm in diameter often accompany or signal the presence of a pollutant that may be the root cause of IAQ complaints.

As depicted in Figure 3, particles are continuously drawn through the CPC or UPC using a built-in pump. Upon entering the instrument, particles pass through a saturator tube where they mix with an alcohol vapor. The particle/alcohol mixture then passes into a condenser tube where alcohol condenses onto the particles, causing them to grow into a larger droplet. The droplets then pass through a focused laser beam, producing flashes of light which are sensed by a photo-detector. The particle concentration is determined by counting the light flashes (each light flash is counted as one particle). If the particles were not "grown" into larger droplets, they would not produce (scatter) enough light to be detected.

The measured size range is typically from below 0.02 to above 1.0 µm diameter. Number concentration ranges from zero to more than 500,000 particles/cm^3 (15,000,000,000 particles/ft^3). The concentration measurement does not depend on the size or material properties of the particle.

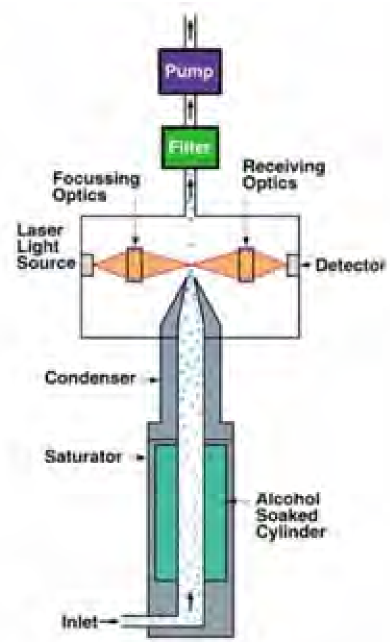

Figure 3
Flow Through a Condensation Particle Counter

CPC's are a very precise means of checking leaks in negative air machines as well as any other high efficiency particle arresting (HEPA) filtration system.

The test that is traditionally done on negative air machines is an industry standard efficiency test that requires upstream and downstream measurement of a generated aerosol (usually DOP) having an average particle size of 0.3 microns. The efficiency usually must meet or exceed 99.97% to pass this test. There are instruments on the market that are specifically designed to perform that test that consist of an aerosol generator and a photometer to measure concentration in milligrams per cubic meter.

CPC's cannot effectively perform the same efficiency test as above; however, it can be used to perform a leak test that is far more stringent. A negative air machine that passes the DOP efficiency test will often exhibit leaks that can be precisely located and eliminated using a CPC. Often, these leaks are found around the filter gaskets, not the filter itself. The leaks may involve thousands of ultrafine particles per cubic centimeter and yet be invisible to a photometer since they are too small to be detected.

When leak testing with a CPC, there is no need to generate an aerosol. This is because ambient air always contains huge numbers of ultrafine particles under 0.1 micron in size that the CPC can see. Leaks allow any size particle to pass through so there is no need to insist on particles 0.3 microns in size. If there are leaks, ultrafine particles will pass through easily. Research has shown that the vast majority of the number of ambient air particles are below 0.1 micron in size, which explains why they cannot be used in the industry standard DOP test.

Leak testing with the CPC involves scanning the filter and the surrounding gaskets. An increase in the particle count or concentration means you found a leak. One precaution that should be taken is to determine if the motor, bearing, belts or other components of the HVAC system may be generating particles. One way to overcome this possibility is to pull air through the equipment being tested (while it's off) using a second machine. A quick check can be made by using the CPC to sample the air in the duct between the two machines. If the particle count is acceptable, you're done. If it's higher than expected, you need to further investigate and find the leak(s).

All three types of instruments—photometers, optical particle counters, and condensation particle counters—have their place in particle investigations. Matching the appropriate technology with your particular application will provide the data you need to understand and improve a building's air quality.

Photometers, which measure mass concentration, provide the necessary data to compare against air quality standards and guidelines. OPCs give additional understanding of particle number concentrations and size ranges of the mid-sized particles to help identify the probable source and health impact. Finally, CPCs offer insight into the ultrafine particles that are now emerging as an important IAQ metric that may play a significant role in the health and comfort of building occupants.

ASHRAE Standard 90.1 and Leakage

Patrick J. Brooks, McGill AirFlow LLC

Introduction

The energy crisis of the 1970s opened the eyes of many engineers to the idea of energy conservation and the improvement of buildings and machinery efficiency. Before then, however, high pressure duct systems were common, as cheap energy led designers to consider the initial cost rather than lifetime operating costs of systems; and smaller, higher velocity ducts were designed, as reduced ceiling space requirements and reduced initial costs were much more important.

The Midwest oil embargo of 1973 changed all that. As oil prices began to rise significantly, other energy sources followed suit, and natural gas and electricity costs climbed as well. Costs rose so quickly that ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.) published ASHRAE Standard 90-1975) "Energy Conservation in New Building Design". The standard eventually split into 90.1, covering commercial buildings and 90.2, covering residential buildings.

There have been major revisions to the standard since then. In 1999, it was put on what ASHRAE calls "continuous maintenance", and it was to be revised every three years to match the publication cycle of the International Energy Conservation Code. The current publication is ASHRAE Standard 90.1-2007 "Energy Standards for Buildings except Low-Rise Residential Buildings". There will be a new revision released sometime in 2010. Along the way, it became an ANSI (American National Standards Institute) standard. In 1992, the U.S. Energy Policy Act required states to adopt energy codes that were at least as stringent to 90.1. So when revising the code, it's important to make sure it has practical cost effective provisions.

What Standard 90.1 Says About Duct Leakage

Standard 90.1-2007 currently states that ductwork designed to operate in excess of 3 in. w.c. shall be leak tested according to industry-accepted test procedures. It does not require testing the entire system, but states that no less than 25% of the total duct area for the designated pressure class shall be tested. The maximum permitted leakage is based on a C_L (duct leakage class) of 6 for rectangular duct and 3 for round ducts, as defined by the equation:

where:	C_L	= duct leakage class, cfm/100 ft^2 at 1 in. w.c.
	P	= test pressure, in. w.c.

Standard 90.1-2007 also shows a matrix of "Minimum Duct Seal Level" for various types of systems and duct design static pressures. The Seal Level is identified as A, B, or C, which are defined as:

A	-All transverse points, longitudinal seams, and duct wall penetrations
B	-All transverse points and longitudinal seams
C	-Transverse joints only

Problems with Standard 90.1-2007 Duct Leakage

There are several inherent problems with the leakage section in Standard 90.1-2007. Because we are in a recent public review period, some members of ASHRAE's Duct Design Committee (TC 5.2) have made suggestions on how to improve the standards. The following is our position (McGill

AirFlow LLC), of which some is shared by other members of the committee:

(1) Ductwork designed to operate in excess of 3 in. w.c. shall be leak tested…

There are many reasons to minimize energy consumption as we try to reduce greenhouse gas emissions and design buildings for net-zero energy use. Energy conservation has never gone away, and as energy prices skyrocket, there are more and more reasons to increase its use.

Sealing duct systems can play a significant role in minimizing energy use. It's been reported that unsealed rectangular duct can leak as much as about 40% of the total flow at 2 in. w.c. static pressure (if it can even be pressurized that much).

McGill suggests duct system leakage be kept at 1% of total flow, or less, rather than increasing fan output to overcome the leakage. We have been saying that since the 1970s when energy conservation first became important. A conditioned area requires a certain volume of air to maintain designed conditions. If 5% of the air leaks out, those design conditions will not be met, at least part of the time. If 5% more air is added by speeding up the fan, the design condition will still not be met, because 5% of the air is still leaking. For example, if I have a system with an air volume flow requirement of 30,000 cfm, it is leaking 1500 cfm, and I increase the fan to 31,500 cfm to compensate, it will leak about 1575 cfm (5% of the 31,500) and still fall short of getting the 30,000 cfm to where it's supposed to go. Only 29,925 will get to the correct areas. To get the true 30,000 to the rooms, I would have to increase the fan output to 31,579 cfm, or by 5.3% of the design cfm. Now, if that original design required a static pressure at the fan outlet of 2.5 in. w.c., with a velocity pressure of 0.39 in. w.c. for 2500 fpm, I would have to increase both the velocity pressure at the outlet and the static pressure to drive the system, because I'm trying to push more air through the original design. The velocity pressure would increase to 0.43 in. w.c. and there would be more pressure drop caused by forcing more air through the designed duct system. These concepts combine to help us understand why we would need an increase in horsepower greater than just the percent increase in volume flow rate. The velocity pressure by itself increased 10%.

For a given duct design, the design fan static pressure (FSP) requirement is a function of the design air flow (cfm). The FSP occurs where the system curve intersects the fan curve for the designed air flow rate. If leakage occurs in the system, it initially actually "relieves" the air pressure, and more volume is produced as the "new" system curve intersects the FSP to the right of the original system curve, along the fan curve (see points D and B on Figure 1). The additional air flow will not make it to the terminals as it leaks out the system.

In order to get the proper amount of flow to the terminals, Figure 2 shows we will have to travel up the new (with leakage) system curve. But, if we just move back up to the design FSP, there is still leakage, so the terminals will still not see the desired cfm. We have to continue to travel up the "leakage" system curve to a new point C, where both the air flow and FSP are increased to provide the design air flow to the terminals.

The fan laws tell us the total increase in brake horsepower will be a function of the increase in air flow to the third power for a system curve or:

where:	BHP_C	= final actual brake horsepower
	BHP_D	= design brake horsepower
	CFM_C	= actual volumetric flow rate needed to overcome leakage
	CFM_D	= design volumetric flow rate

However, since we moved to a new system curve, the fan laws are not directly applicable. They would be applicable to just the new system curve if we could clearly identify it. What we know, however, is that the increase in brake horsepower is probably going to be a ratio between the second or third power of the air flow rate, depending on how close that new system curve is relative to the original.

In the example, the increased brake horsepower will probably be:

Therefore, the actual brake horsepower will have to be 11% to 17% higher than the design brake horsepower to overcome the leakage. That is a constant recurring cost over the life of the air handling unit, which is also wasting energy.

It can be shown that even at a design static pressure of 2 in. w.c., with 3% of volume flow leakage, the brake horsepower would need to increase by 6.3% to 9.6% to get back to the room designed airflow rate. Now, the fact is that as air flow increases through the system, it loses total pressure. But, if a system is designed using static regain, the static pressure does not decrease (especially significantly), as that is the purpose of static regain. So this pressure is constantly forcing air out of the system at leakage points. Also, to reduce energy consumption, many systems are designed to operate below 4 in. w.c. static pressure. If the system static pressure did not exceed 3 in. w.c., Standard 90.1-2007 would not even have required it to be tested. Therefore, McGill would suggest that all duct systems and components, in excess of 1 in. w.c. static pressure, be tested to assure duct leakage is minimal. This is easily doable with round/flat oval systems.

(2) The maximum permitted leakage is based on a C_L of 6 for rectangular and 3 for round.

Why should rectangular duct be allowed to leak twice as much as a function of surface area than round? Round designs typically have less surface area for the same system design pressures to begin with. Standard 90.1-2007 basically penalizes round designs by saying they have to leak less than one-half as much as rectangular. If the system example from before had 30,000 cfm and a total surface area of 10,000 sq ft. for a 2 in. w.c. static pressure, the allowable leakage would be 3.1%, or 930 cfm for a rectangular system. If a round design was used that took 10% less surface area, the round duct system would be allowed to leak only 1.6%, or 28,500 sq. ft., or 462 cfm.

The allowable leakage should be a system parameter, not a function of the duct shape or surface area. The allowable leakage rate, according to Standard 90.1-2007, cannot even be applied to all duct shapes, such as flat oval or semi-circular; and flat oval ducts are very common in the industry now. The fan doesn't care where the leakage is. It must still be sped up to overcome it. McGill's suggested change would be to specify that all systems have maximum leakage of 1% of total volume flow regardless of duct shape. That would have made the allowable leakage for air sampling systems equal to 300 cfm.

(3) ...no less than 25% of the total installed duct for the designed pressure class needs to be tested.

Some organizations in the industry propose that no testing be done, and that visual inspection be used. Other engineers want entire system testing. McGill is close to agreeing to what is in

Standard 90.1 – 2007, but with some additional stipulations.

We agree that only 25% of the system should be tested, but only if it adequately passes the leakage test. For quality assurance and reliability, the design engineer should let the installing contractor know which part of the system will be tested after the installation is complete. If done prior, the installing contractor could take the position of doing a great job sealing the known test section (even pre-testing it to make sure it passes), and then relax standards on the remaining sections.

The installing contractor would run tests in a way to make sure the system is meeting the leakage specification. If the test section selected by the design engineer fails, then 50% of the system should be tested (assuming the contractor "fixes" the problems first). If 50% of the system fails, the installing contractor would have to have the entire system passed.

When the proper leakage tests are passed, the testing and balancing people should feel confident that the leakage will not be a problem when determining the proper air flow to the building's rooms, or that at least the problems are not caused by leaks.

Other Potential Problems with Standard 90.1

The average engineer or contractor reading the section on leakage in Standard 90.1-2007 would probably agree that it is addressing only duct leakage, not component or system leakage. This means that contractors will isolate some of the components that have the worst leakage in the system, which could be fire or smoke dampers, access doors, reheat coils, and air terminal units. All of the components can leak air into unconditioned spaces, and in general, not allow the air to get to where it's supposed to go. The fan does not care where the leakage is, it simply has to be increased (faster, bigger, or whichever) to supply the designed air flow to the rooms. Therefore, the components must be included in the leakage test and the manufacturers of those components held accountable. The best way to do this may not be known, as the components are often specified and they are clearly not under the control of the installing contractor. However, as with the duct they are installing, the installing contractor must be the policeman to hold the manufacturer accountable, and they themselves should only be held accountable for installing the components correctly. ASHRAE is working on standards to address that, but ultimately Standard 90.1 needs to address systems, not just ductwork.

Summary

There are many reasons to design efficient, leak-free duct systems:

1. To reduce energy consumption
2. To reduces greenhouse gases
3. To reduce operating costs
4. To maintain human comfort
5. To minimize a source of pollution
6. To minimize the spread of smoke or gases

Air does not know where it is leaking. Leakage must be minimized in all components and duct shapes. Duct systems must be tested for quality assurance and should be part of commissioning buildings. Owners who pay the bills, occupants who need to be comfortable, testing and balancing companies who must balance the systems, and engineers and contractors who will get repeat business for doing quality jobs, will all benefit.

Engineers can specify that duct systems meet more stringent specifications than the ones in ASHRAE Standard 90.1-2007. McGill hopes that ASHRAE will adopt more stringent leakage standards for everyone's benefit.

Wireless Energy Management Systems Building Bottom Lines

Davis Watkins, Advanced Telemetry

As an HVAC contractor, it is certainly not news that the current business environment is tough. But, even in the best economic times this profession is challenged with growing revenues, increasing profit margins and expanding market share. Even when business is booming, competition from new players in your market amid an industry that rarely grows over 4% each year makes it difficult for even the best-in-class HVAC contractors to survive…let alone thrive.

Those of you who regularly attend business building seminars have surely heard great advice about working smarter, selling more accessories and higher efficiency equipment, and otherwise pursuing jobs with lower labor allocation and higher profit per man hour. This is all excellent advice, and should absolutely be a part of your overall business strategy. What you should be most excited about, however, is the recent advances in wireless network technologies and how these advances have opened up a large segment of new business opportunities for your HVAC company.

What is being heralded as a new class of "drop in" energy management systems (EMS) for small to mid-size commercial buildings has arrived, made possible by the recent advances in wireless technologies. Quite simply, an entire segment of commercial buildings that was previously unable to afford a sophisticated EMS now has some very compelling options. What these affordable, feature-rich wireless EMS products offer this untapped market segment is real energy savings that enhance profitability and a reduced carbon footprint in line with increasing demand for companies to employ green business practices. What's equally exciting about this technology is its operational simplicity and ease-of-use.

Until now, most businesses that occupy a space in the 10,000 sq.ft. range have had no affordable option to implement a building management system of any notable scale. And ironically, a large portion of this building-size segment uses more energy per square foot than any other commercial space. These are the hundreds of thousands of quick serve and fast casual restaurants, convenience stores, banks and retail spaces across the U.S. As you might imagine, HVAC equipment on the roof is the largest source of energy drain for these small to mid-size businesses. For restaurants in particular, these systems can be responsible for fully 40% of their total energy bill. And, until recently, there have been no practical energy management solutions to better control these HVAC and other mechanical systems and, therefore, no opportunity to save money.

So how does wireless technology rectify this situation? In much the same way a wireless network in your home can support multiple devices, like a laptop, desktop, printers, and handheld video games, a wireless network system can now be deployed into a commercial building. These wireless networks will support multiple controls for that building's main energy using equipment - HVAC and lighting. The system also allows for real-time wireless monitoring of the total electrical consumption (KwH) for the entire building. More importantly, it takes the entire process straight to the Internet, enabling remote monitoring and control from a central location.

What makes these wireless EMS systems so attractive is their simplicity, effectiveness and affordability. Most HVAC contractors can install these systems in just a half-day or less by replacing the existing thermostats in the building with radio equipped wireless thermostats. A factory accessory will allow wireless control of up to eight other circuits for lights, ventilation or cooking equipment. Basically, any equipment that could benefit from having an operation schedule applied can usually be joined to the network. Next, simple current transformer clamps are slipped around the main electrical feed lines to the building, and they are joined to the network. Then, a real-time graphic interface touch panel display is installed on the wall in a manager's office. This panel is actually the new local central control and monitoring point for all HVAC equipment, lighting, refrigeration and other mechanicals. Simply enable the power and Internet connection button on the back of the touch panel, and the building is now saving energy, saving money and controllable remotely via the Web.

The value propositions for the HVAC contractor are many. First and foremost, a wireless EMS solution can actually transform your current relationship with these small to mid-size business owners from reactive to proactive. Instead of waiting for your commercial customer to call when something breaks down, or making a minimal profit on the twice yearly PM checks, you'll champion and foster your customers' profitability, thus strengthening your relationship. This new class of wireless drop in energy management systems will typically provide business owners with a payback on installed cost (ROI) in less than one year. After that, all electrical savings transfers directly to the bottom line profits of that business.

In addition, these systems can even provide your firm with a recurring income stream by offering you the opportunity to be the remote "gatekeeper" of each building you upgrade with these products. From setting schedules through the Web interface, to being the contact that receives and responds to any over temperature alarms, to creating monthly comparative energy consumption reports, your firm will become a vital part of your customers' success. All this for a small yearly fee paid to you that can easily be integrated with other services or PM contracts.

In this business segment desperate and clamoring to control energy costs - the only discretionary expense that can be better optimized for enhanced profitability in this sector – wireless EMS systems offer unprecedented opportunity. And you, the HVAC contractor, are uniquely positioned to capitalize on this opportunity, since you already have the relationships with this segment and, even better, there is virtually no competition from the big controls companies that cannot provide a scalable solution that can be affordably deployed.

As the economic picture gets a little brighter, try not to fall back into old habits and complacent business practices that have limited fiscal upside. Continue to look for new strategies and technological opportunities that will help differentiate your company and not only maintain, but increase, your profitability. But most importantly, do some research on emerging wireless energy management systems that will undoubtedly help you become a true solutions provider to your customer base hungry for ways to easily and inexpensively cut their astronomical electrical costs. In doing so, your company can finally assume its rightful place in the controls business.

NEBB Jumps For Horse Park

The Alltech FEI World Equestrian Games featured the world championships for eight equestrian sports from September 25-October 10, 2010. The Games are staged every four years, and this was its first occurrence in the United States, at the Kentucky Horse Park in Lexington, KY. Attendance topped 500,000 across the 16 days.

The structure which houses this event was Kentucky State Horse Park in Lexington Kentucky. The team at EBCO, NEBB Certified Professional, Keith Turner, and Certified Technicians, Darin Leach and Randy Tuner delivered a high performance building for this structure.

EBCO, a NEBB Certified Firm, completed the Air and Water Balance. The job was bid directly to the State (Commonwealth of Kentucky) as a State project. In Kentucky, TAB work is solicited directly. On this project, there were two bids requested, from EBCO, and from the only AABC company in the state. EBCO won the job.

Scope of Work:
A general description of the project: a world-class 206,100 square feet Indoor Arena facility for the use of Equestrian events as well as larger concert events held on the Kentucky Horse Parks' 1,032 acre park.

The building is a two-story facility with a mezzanine with private Suites, 5,600 permanent seats with a possible 8,860 seats for concert venues. The Main Entrance to the facility is located on the west side of the building – Concourse level. There is a varied Exhibit Hall and Plaza on the South side of the facility and an Add-Alternate of a varied Exhibit Hall/Specialty Meeting and Convention Spaces on the north side of the facility. Catered Food Service with a Warming Kitchen and Concession stands around the Concourse Level. The Arena Event floor is 150' x 300' with attached indoor Warm-up barn, and staging areas. 485 spaces Parking lot, Loading Dock area and Drop-off area are all part of this project.

TAB Data:
290,000 CFM of airflow supplied by 6 Air Handling units
725 tons of cooling from 3 Trane Chillers
13 Exhaust fans for restroom and smoke evac system
VAV system serving multiple suite areas
6 base mounted pumps serving cooling and heating demands
9 circulating pumps serving CW and HW coils
2 Cooling towers

For more information about this project, contact NEBB Certified Professional, Tim Chinn at EBCO.