The NEBB Professional

December, 2011

- The Other TAB… Vibration Anaysis
- Balancing for Variable Flow
- Transparency in TAB and BIM
- Tracking Down Success in Your Business
- Monitor Outside Air Intake Flow Rates on Small Packaged Units
- Q&A: Pressure Independent Valve Technology

FEATURE ON NEBB FIRMS:

- TAB at an Air Force Base
- Helping Clients Achieve Green Award
- Worldwide Energy Savings Study for a Global Company
- Testing Environmental Systems at the New Walter Reed Center
- Focus on LEED = Need for NEBB Certification

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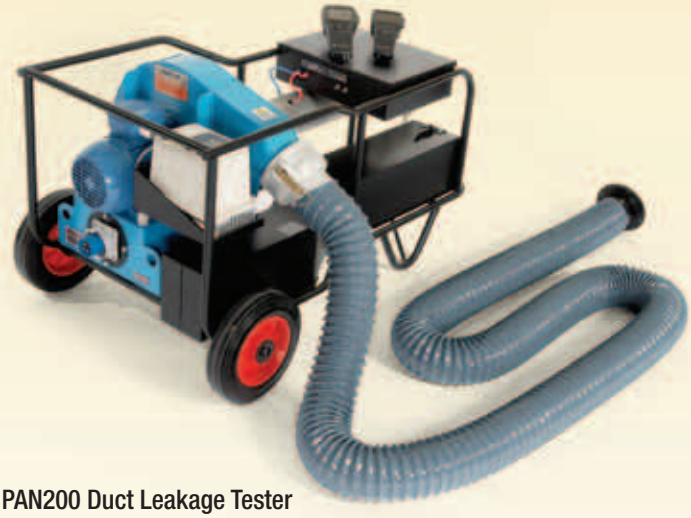

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Letter from the NEBB President

Thank you – there is simply no better words to express my gratitude for the warm welcome NEBB members have extended to me as I begin my new role at NEBB. I have been involved with NEBB for the last 6 years. I am amazed by the spirit of volunteerism of our members and supporters. This spirit drives us to achieve successes and pull through to the top in trying times and other ups and downs.

I am honored to have been involved in NEBB Committees and BOD for years. One of our members reached out to me recently and inquired about volunteering. He was wondering if an hour here and there would help. I can tell you what I told him - it really does count! It doesn't matter how much you can devote but every bit helps our committees and chapters achieve their goal but also to ensure that NEBB to spread the word about the good work our members are doing in the HVAC industry and also improve the world we all live in.

The 2012 NEBB Annual Conference is going to be held on April 26-28, in Anaheim, California. In the coming days, you will receive information about the outstanding agenda with a great line-up of speakers our conference attracts, as well as about the excellent networking opportunities this event offers. My wife Sandra and I, look forward to welcoming you in Anaheim soon.

On behalf of the entire NEBB team, we look forward to reaching even higher in future, raising the bar for the industry in building a bridge to the future.

Neil Marshall
President

Index of Articles

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The Other TAB… Vibration Analysis

***Alan Richardson*, PVAC President and a member of NEBB's Sound and Vibration Committee**

Ok… so you have been working in TAB for years and thought that what you did was Test and Balance… well, there is a "Whole Another World" out there. Now this might give your brain a shake or a brain cramp… but balancing airflow is not considered as Test and Balance by many professionals. To them, test and balance has to do with the health of the rotating machinery from a vibration standpoint. This article is really about explaining a different culture to a foreigner where neither can understand the other, yet they are using the exact same phrases… exact same words. Each thinking they are right and denying that the other person might have a point.

This is the reality of building commissioning and what is being copied into a specification by a coat and tie cubical occupant – specification writer, who may never have seen nor touched a variable volume control system nor taken apart a fan that died from bearing failure. Clueless in his or her cubical writing and copying from preformatted, computerized and purchased from some resource neat sounding but only partially functional specifications created and edited in absence of hands on experience.

The reality is that both types of TAB are important at commissioning and retro commissioning time and both should be done by **third party professionals** not being paid directly by the contractor or the architect. That's right! Don't let the fox in the chicken coop or leave the keys in the ignition. Temptation is temptation no matter how you slice it.

Bottom line is that Vibration Analysis should be conducted on every building being Commissioned (CXA) or Retro Commissioned (RCXA) and should be done before the contractor is fully paid. Many large firms that are building facilities and data centers such as Wachovia, have already figured this out and use Vibration Analysis at commissioning time, to first verify that the rotational equipment is installed correctly. That is only part of their reason for using a Vibration Analysis TAB Professional (in the rest of the article I will use the term TABv Professional). The second reason is to establish a footprint for every critical piece of rotational equipment. This footprint can then be used as a yardstick in evaluating the maintenance of the facility, for every year after the initial commissioning, whether the building is being maintained by a contractor, or by the company's maintenance staff. The reality is, the TABv Professional can identify what is going in the plant's machinery where the naked eye and ear cannot. This is similar to getting a CAT Scan at the hospital. The doctors can see all kinds of stuff that is not readily apparent. Likewise a qualified TABv Professional can identify for the owner all sorts of things that are going on in new or existing equipment. He can see everything that is going on in the pumps, fans, cooling towers, chillers, compressors, etc. If it rotates, you can measure it with accelerometers. Once it is measured it can be tracked, trended and diagnosed.

Balance may be an issue and that typically shows up at one times the turning speed, while misalignment is identifiable at higher orders (an order is one times the turning speed in TABv language). Belt issues will

show up at less than one order and many a TABv Professional has been brought on site to balance a fan when in fact it had a bearing going out. Balance can be measured and tracked at one radial orientation on the shaft. If it is imbalance, then a counter weight can be added to "balance" the fan. If the bearing is going bad and starting to spin on the shaft, creating a jerking action that might appear to the untrained ear to need balancing. This latter condition causes the high force angle to jump around, and the fan will not be able to be balanced. I have found that even new bearings, straight from the factory can be frozen causing this condition and heart burn for the contractor during commissioning.

The neat thing about TABv is that with the advent of computers, the TABv Professional can now diagnose all sorts of things, using algorithms (mathematical formulas) inside the data collector and the TABv Professional's computer, to tell the owner whether the failure is the inner race, outer race, roller or cage of the bearing. On the other hand the problem may be an alignment issue or that the belts are too tight or too loose. Fan stall and pump cavitation is also discernable along with rotor bar issues in the motor. All this is discernable without shutting down the system or disassembling anything.

Safety needs always to be of concern for the TABv Professional since he is always in close proximity to rotational equipment and must never let his guard down. Cables to accelerometers are now available with breakaway splices so that if something got caught, it will not pull the TABv Professional into harm's way. Likewise reach poles are available in a variety of lengths to keep all fingers and arms out of danger. Cooling towers are sometimes of particular concern, since there is more to be concerned about that the path of the blades as they rotate. The up draft from a good-sized cooling tower can be substantial, lifting the cables, or even the reach pole into the path of the blades. This is when caution must take precedence over speed. Shutting down and locking out the tower for a few minutes might be required to allow tie wrapping the accelerometer cables to the structural braces before collecting each reading. Being safe is much better than a hospital visit on any day and no one wants an OSHA record able on their records.

RCXA is not forgotten for the TABv Professional. In fact, there is presently more need for the TABv Professional in RCXA and the Preventive Maintenance or Prognostic area than ever. By collecting non-interruptive vibration readings and computerized vibration analysis, the TABv Professional can help the owner's maintenance team find developing problems before they become terminal.

History has shown that early problem identification can facilitate preplanned corrective action, minimal overtime expenditures, and fewer rushed parts deliveries and airfreight bills. Whether it is a pump, a fan, a motor or a gearbox, vibration analysis can find evolving issues and track-trend them for effective lower costs solutions, instead of experiencing emergency breakdowns, shutdowns, and production stoppages.

The question arises as to how to get started in establishing a proactive Vibration Analysis Program at your facility, whether just being built or an existing structure. A good way to get started is to collect vibration data on every important rotating machine or system in the facility. As a rule of thumb, on roof top ventilation systems, I have found that the small units are probably not worth the investment in vibration analysis. By small I mean, you would

have to take a screw gun and disassemble the outer sheet metal housing to get to the rotational parts. Typically, we do roof top units that have a latch or door handle that exposes the rotational items for easy data collection. The first step to any Vibration Analysis job is to identify what is to be measured and set up a database to collect the vibration data in. This database set up can be tedious and includes identifying what bearings are used where, how many gear teeth are on each shaft, and how many rotor bars are in each motor.

Once the database is created, the data can be collected. The best way is to establish a repeatable footprint is by collecting three months data in a row. This allows the TABv Professional to make a recommendation on what frequency the future vibration data should be collected, based on what is actually happening in the facility. For many facilities like schools and office buildings, bimonthly or quarterly vibration data analysis is adequate. I would not recommend going a full year between vibration analysis data collection, however, this better than nothing and some underwriters consider this an important step in determining that the facility is being properly maintained and is worthy of being insured for another year.

The bottom line is that Vibration Analysis by a TABv Professional is essential to the Commissioning of new or the Retro Commissioning of an existing building. Vibration Analysis should be conducted before contractor payments are finalized. In addition, the TABv Professional can be a tremendous asset to the facility owner's maintenance team, providing them with advance warning of impending problems so that they can adjust maintenance procedures on the unit or get parts ordered and fix the system before a failure could disrupt operations. It is a lot easier, and a lot less expensive to fix something on straight time with delivered parts, than with overtime and improvised parts.

The TABv professional can make everyone's life at work easier and help protect the Owner's Assets form failure. Are you using your TABv Professional's expertise to your advantage? ■

Balancing for Variable Flow

Bill England, Hydronic Training Manager | Flow Design Inc.

Many articles have been written that champion various new approaches to water side balancing. All for the most part have been initiated as a result of our attempts to control energy costs as well as provide basic creature comfort.

ASHRAE's original definition of a balanced system goes like this, "A balanced system in water side terms can be defined as one in which the terminal unit flow rates are **adequate** under **design** circumstances, to maintain **satisfactory** heat transfer capability".

There are only two issues in this definition that no longer seem appropriate when we are discussing a variable flow system. ***First, a building is rarely at design conditions.*** Most commercial buildings operate at less than design. In fact 75% of the time commercial buildings may be operating at 50% design load. ***Second, the words adequate and satisfactory lack specificity.***

If we are truly going to address the issue of balancing for variable flow let's define a balanced system this way, "A balanced system in water side terms can be defined as one in which the terminal units receive the **required** flow rates under **all operating conditions** to maintain **maximum** heat transfer capability".

In other words, our objective is to: **Match the Flow to the Load in Every Heat Transfer Device at All Operating Points without Excess Flow.**

Most systems attempt to accomplish this with variable speed drives, sensors and the following at the terminal units:

- A modulating control valve in series with an automatic balance valve
- A modulating control valve in series with a manual balance valve

OR

- Allow the modulating control valve at the terminal unit to react alone to all dynamic pressure changes and reset

An automatic balance valve may exhibit dynamic pressure control but only at design flow, which is why automatic balancing is the equivalent of pressure independent control in on/off applications. However, the automatic balance valve does not control once a modulating control valve assumes authority which is anytime the coil is operating at part load.

If the modulating control valve is in control of a specific circuit at reduced flow, and we have pressure fluctuations in the building that changes the inlet pressure to the coil, the flow through that coil will change. This change in flow will remain until the heat transfer through that coil is impacted significantly enough to have a sensor react to tell the control valve to throttle more or open up.

We can minimize effects of pressure variations in a building and better control differential pressure by:

- Using equal percentage modulating control valves
- Taking as much pressure drop across the control valve as practical to maximize control valve authority
- Minimizing pressure drops in distribution piping
- Using automatic balance valves

Beyond these more traditional designs, we must look at differential pressure control valves, which can maintain almost constant differential pressure and thus minimize the ill effects of pressure fluctuations in the control valves. The differential pressure control valve may help in reducing the pump head and keeping high controllability in the system. ■

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Transparency in TAB and BIM

Andy Stadheim** P.E. | **BuildingStart

Part of the digital age and technology has added a layer and level of transparency that can tend to make people uncomfortable. Technology has to some degree both raised our privacy and lowered it at the same time. We are in the digital age and transparency is now a reality, not necessarily a choice.

This article will touch on two main topics. First we will discuss transparency in TAB work. And second we will cover transparency and BIM and how the lack of transparency at the manufacturer level is one reason BIM isn't more widely adopted yet.

Transparency and TAB

Often times we hear companies uncomfortable with having the TAB results fully available online immediately. Some common responses are: "A Supervisor hasn't checked the work yet.", "We aren't done yet." and "People don't understand this report is Preliminary.".

The reality is you are forced to provide this documentation unchecked frequently anyway. Typically it's a demand of seeing the "field paperwork", requiring you to photo copy your hand written work on site and hand over the "work in-progress" data.

Recently I was speaking with a TAB contractor expressing his frustration with this demand for "in-progress" data and said a recent job they were on required a copy of field paper work for every 10% increment of completion. Obviously providing 10 copies of your documentation at various stages of completion is a hassle at best. Certainly from the owner or GC's viewpoint you can understand the request, especially if it's tied to progress billings on a large TAB project.

TAB work is really observations of how other contractors are performing. You are one of the quality control components in making sure the system is working properly which is one reason a large number of TAB firms have the expertise to provide commissioning services. Both services are a quality control layer on how a building is tested and ultimately on how well a building will perform long term. Increasing the level of transparency in your TAB process maybe a little uncomfortable at first, but providing transparent and quality TAB services will be appreciated by most of your customers.

Transparency and BIM

The lack of transparency from industry manufacturer data has made fully adopting BIM practices more difficult. Some of the challenges are rooted in how the industry has always operated. It started with "Catalog Rooms" that every good A/E firm had. You could walk into this A/E library and pull out catalogs on everything from Roof top units all the way to and including the kitchen sink. However, if you wanted to compare a roof top unit you had to pull, not one, but multiple catalogs on rooftop units, Carrier, Lennox, Trane, York etc. Alternatively, engineers would have preferred manufacturer and then have equipment suppliers bid "comparable" units. In some cases engineers can require a "variance" to accept alternates. This old catalog fiefdom has migrated into our digital world, but, unfortunately has maintained the same fractured eco-system. Each manufacturer has developed their own sizing and selection programs that show only their equipment. Of course they are not going to compare competitive products; why do that when you can control the selection process?

Look around other industries that have already made the move.

In the Insurance industry, Progressive Insurance will actually retrieve quotes for you including what their competition might quote you. Can you get any more transparent than that?

In electronics, there are countless sites that compare pricing of the same device across many web resellers and also many sites that let you compare similar equipment. I typically give the Best Buy.com analogy because it compares similar devices across manufactures. Imagine the power of pulling up a list of all 20 Ton Rooftop units and comparing features side by side? Technology certainly isn't the limiting factor stopping this from being a reality.

Manufacturers can play an important part in truly making BIM the full life cycle repository of building data that it was intended to be by increasing their level of transparency in the industry. If the manufacturer is sharing data digitally, everyone downstream of the source can benefit from the data as well. I believe the first manufacturer to fully embrace this concept of transparency will benefit significantly. ■

Tracking Down Success in Your Business

Derek Hedrick, President | Ameritech Computer Consultants, Inc.

There are two ways to build your business in today's economy. **First** you can work harder to take some market share from you competitors or **second**, you can find a way to expand your offerings. *No matter what path you choose you will need to consider the use of technology and how it can be used to improve your situation.*

Right now competition is fierce. The margins for profit and error are slim. It used to be, when you made a mistake you would lose a little or if you did everything right; you could make a pretty good profit. Now, if you make a mistake, you can lose your company and even in the best of worlds your profit margin may not be that great. So how can we change this situation and improve our business in a way that lowers risk and increases profit margins?

The push today is to emphasize improving your sales and marketing. Learn to negotiate better, build the relationships, sell harder, work on developing your accounts, provide better service, and reach for more sales within the company. But one area, the formal bidding process is not discussed much or is totally ignored. Some companies use the bidding process almost exclusively. Instead of selling with major sales staff, etc., these companies spend most of their time sending in their request to bid and then preparing the best bid possible. But how can that system be turbocharged utilizing technology?

The whole concept of the bidding process was designed to keep the process as pure as possible from the human bias or influence. Sometimes the bid is directly for a company or a government agency and sometimes it is as a sub-contractor for a General Contractor. For those who are the "guardians" of the process, (the purchasing department, a contract administrator, or the general contractor) there can be a real commitment and belief, that the process works and provides the best system for keeping it fair for all. However, not everyone sees that quite as black and white. Regardless, a company can utilize the bidding process to their advantage with some help from technology.

Let's consider the bidding process. Some bids are annual; some are based on a one time project. But no matter how the bid comes to the bidder, they must understand that someone has a need or problem that they want this bid to solve. They are usually the person that has the problem; they specify the scope and basic details of the project. Then the guardian (usually someone other than the problem owner) tries to scrub the project of any bias or human influence. They may even threaten to toss your bid out if you try to circumvent the guardian and the process in any way, a threat not to be taken lightly.

In order to take advantage of this "inflexible" bidding process, your best weapon is still information. And since the guardians do not want you to bypass their system, the information may have to come from somewhere else. There is value in understanding the strengths and weaknesses of your competition. There is value in knowing who is bidding, and what their bidding award record has been for the last six to twelve months. This information can be collected and compiled using the right software.

Software today can keep track of your competitors and help you to understand what makes a particular project a good candidate for you or for your competition. Knowing that one competitor may have some new equipment which gives them an advantage in production may also mean that they have additional overhead expenses that you don't have. If your labor costs are lower somehow due to location, proximity or other reason, then you may have an advantage over a competitor.

Since costs are a driving factor in the bidding process, to keep your profit margins in a project, the more you

can track your costs, and keep them low, the better your chances of winning a bid. Lowering costs or keeping them low, starts with detailed planning and quality execution. Using the right software enables you to collect, and analyze specific information, and will enable you to make decisions or changes quicker.

Successful businesses use a test and measure concept to continually develop their planning and execution systems. This in turn improves their quality and profit margins. Testing and measuring means you create a system in every area of your business. You can then find a way to measure everything that you do. Peter Drucker said, "If you can't measure it, you can't manage it". Measuring every variable such as man hours, materials per unit, travel time, administration costs, etc., for each project is critical. Once you have established a way to measure the values of a system or process, you start testing.

Once a system is measurable, a baseline must be set. It is then subjected to creativity or innovation processes where alternative options are developed that might bring a better result. The system is adjusted to reflect that change, and then measured again. The results are compared, and it is determined if the changes have improved or diminished the results. This data can be tracked through effective project management software.

Monitoring your project after an award is just common sense in business. A computer program can make that process easier, and more valuable for you. As an example, let's just say a mid-level technician was plugged into the estimating process to provide 100 hours of service on the "Alpha" project. Using a quality scheduling program, the details are plugged in so that benchmarks and status reports can be generated. As that project moves along you can see if there is more or less time being administered by that technician than was estimated. If there is more time, it might be a good idea to understand what is causing the extra hours because the business could be losing money. On the other hand if the technician is below time, it could mean some extra profits or that something is not getting done that the customer is expecting. Or maybe someone else is doing the work other than the mid-level technician and that person may cost more.

Information flow is critical in controlling projects and making decisions. There is so much information coming into each manager that it is sometimes hard to know the difference between quality or usable information and useless waste of time information. When you have developed a means of measuring every system or process, you learn the significance of variations. You then create information flow systems that alert you to changes that lie outside of the acceptable norms or variables. While this is very common for some businesses within the technical operations of their business, they often forget to apply these same principles to the business or management side of the business. And while the discussion here is leaning toward the bidding process, it can be applied in all different aspects of a business.

Tracking project costs in an accurate and timely manner is another way to keep costs down, and margins up. Let's say a Project Manager stops in at a job site and sees a piece of rented equipment sitting in the corner. He knows that particular piece of equipment has not been used on the project in the last week. He uses his laptop, I-pad or even his smart phone and looks up the subcontractor who is using it to check on expenses that have already been turned in. A week ago he was invoiced for that equipment. He will not accept an additional week beyond that last statement. Or he sends a quick email to the sub-contractor and lets them know that an idle piece of equipment needs to be removed and should not show up on the next expense report. Having the information at your fingertips can save you time, hassles, and money.

How many companies have a week or two of expenses that they don't invoice for until the next month because their system has a 10 to 14 day lag time? That means, a cutoff date is given to the foreman of when he needs to get his billable expenses to accounting, and then the invoice goes out 10 to 14 days later. This delay is causes unnecessary delay in payment and higher carrying costs.

When accurate invoicing is provided quickly, there are no delays or time lags in understanding why certain charges are being made or costs attributed to a particular project, and invoices are sent quicker, they get paid quicker and less work is required to justify

those costs. A good management software program can help accomplish this.

Successful businesses understand the value of tracking their competitors. As much information on each bid or project can help you to understand your competitor's strengths that they are relying on to compete against you and everyone else. Each business is unique in its own way and that uniqueness is what keeps the business world from being a commodity. Being unique allows true competition and greater efficiencies. Tracking all the information you can on your competitors will provide you that advantage.

Gathering information about your competitors, clients, and vendors is very important and accomplished by asking questions and doing your research. Again technology is your greatest tool to accomplish this and recording the information is the key. When you make notes about the details that are often overlooked, it makes a difference in winning bids, keeping clients happy and understanding the products or services that a vendor can and cannot provide. Here the saying is true that, "Knowledge is Power".

Every vendor and contractor in business must, from time to time, put together quotes for the formal bidding process. If you are wrong on your estimates you can lose your shirt, and if you are too aggressive you can lose the bid. Obviously, you have to bid what you feel is accurate and what you can live with or want for profit margins. But the art of bidding comes down to not just the operational estimates of expenses, but knowing where and how you can beat your competition and how you can lower and keep your costs low.

Technology is a tool that can be leveraged in all aspects of business to make projects flow smoother and with greater profits. When you use the technology effectively you can measure and then test your systems quicker and with greater accuracy. That ability is very valuable and not very common in business. For those who master this aspect of efficiency, stand a better chance of surviving and thriving in today's economy.

With the use of project tracking software you can now see the processes that are hindering the profit margins of your company. You can now focus on these areas and develop plans to minimize the impact of these areas on your business. So the next time you are wondering how you are doing on a project, just remember, if you had a way to track that project, you would know instantly. ■

Monitor Outside Air Intake Flow Rates on Small Packaged Units

Len Damiano, Vice President | EBTRON

Monitoring intake flow rates is essential for LEED, ASHRAE 62.1 and 189.1 compliance. And it makes good cents!

Introduction

Small systems comprise all types of small packaged handling equipment, which when combined serve the majority of the North American working population. Using TAB practitioners to set up intake control devices and establish a field measurement reference are services needed to maximize the performance of air velocity instruments which may have a minimum number of sensors. It also allows TAB to more reliably set the position of fixed intake dampers. Other benefits from combining permanent instrumentation with TAB services are examined, helping to justify the addition of low cost instruments to smaller systems.

Small System Definition

For the purposes of this paper, small systems will be defined as any packaged unit between 3 and 15 tons. These systems are typically "low cost" and sensors are often omitted as a result of first-cost considerations.

ASHRAE Standards 62.1, 189.1 and LEED

ASHRAE Standard 62.1

ASHRAE Standard 62.1-2010, *Ventilation for Acceptable Indoor Air Quality*, specifies minimum outdoor airflow rates for acceptable indoor air quality and has been incorporated into local and national building codes.

ASHRAE Standard 189.1

ASHRAE Standard 189.1-2009, *Standard for the Design of High Performance Green Buildings*, has a mandatory requirement that outside airflow measuring devices are installed on any air handling unit with variable air volume.

This standard also requires that outside airflow rates on all units are documented quarterly and allows the use of permanently mounted airflow measuring devices to be used for this purpose. Use of a permanently installed device will reduce the time and cost of verification.

LEED

LEED currently awards 1 point under *Indoor Environmental Quality* for installing and airflow measuring device in the outside air intake of all air handlers serving low occupant density spaces. Proposed changes in 2012 will require direct outdoor air measurement, as a prerequisite, to all variable air volume air handlers. LEED also awards 1 point for building flush out, which can be accomplished by totalizing the output signal from a permanently installed airflow measuring device during system startup.

Install a permanently mounted airflow measuring device in each outside air intake

Select the Right Airflow Measuring Device

It is the minimum outside airflow rate that is of concern and the low flow rates severely limit the application and selection of airflow measurement equipment. Minimum outside airflow rates on most packaged units are between 50 and 100 FPM. For most outside air intake applications, the technology best suited for low airflow measurement is based on the principle of thermal dispersion. Thermal dispersion flow meters have maximum sensitivity at lower airflow rates and many are calibrated and accurate to 0 FPM (still air).

Make sure it has built-in alarm capability

Since most small packaged units do not have sophisticated controls, having the ability to provide a remote alarm is critical. Make sure the airflow measuring device has either an integral alarm or has its output signal connected to an alarming device that can notify the facility manager/operator when the unit is operating outside of design tolerances. Both LEED and ASHRAE recommend an alarm tolerance of 15%.

Use it to set the minimum intake damper position

Many problems on small packaged units result from the improper setup of the minimum intake damper resulting in insufficient or excess intake flow during operation.

Minimum outside air intake flow rates on small packaged units, especially those having an airside economizer installed, can be as low as 50 FPM. Field verification techniques at these low flow rates have considerable uncertainty as a result of instrumentation and sampling errors.

When the proper permanently mounted instrumentation is installed, it can be shown that the airflow rate measured can linearly track the entire airflow operating range of the economizer from minimum to maximum airflow. As a result, verification, and field adjustment, if required, by an air balance professional can be conducted at 100% economizer. This higher airflow rate is within a range where field measurement uncertainty can be used with a high degree of confidence. The minimum damper position to achieve the desired minimum ventilation rate can then be confidently set using the permanently installed measuring device.

Alarm for system malfunction

Many operational problems on small packaged units go undetected for months or even years, resulting in excessive energy consumption from over-ventilation or by subjecting occupants to poor indoor air quality from under-ventilation. In many cases, these operational problems are a result of damper binding or actuator slippage that could be detected and alarmed using the proper airflow measuring device in the outside air. In other cases, clogged or partially clogged intakes can go undetected for extended periods of time.

Benefits of maintaining proper intake flow rates

Temperature and Humidity Control for Thermal Comfort

Temperature and humidity control problems arise when the mixed air conditions upstream of the cooling and heating coils exceed the mechanical heating or cooling capacity of the system. This will happen if minimum outside air intake rates exceed the design capacity of the system since minimum outside air mode occurs on these systems when the latent load is high (cooling) or the heating load is high (low outdoor temperatures).

During mechanical cooling, these systems can provide proper temperature and humidity control of the supply air as long as the latent load of the mixed air is within design limits. However, if the mixed air latent load exceeds the system's capacity due to excess outside air, the supply air conditions required for proper temperature and humidity control will not be maintained and space temperature and humidity levels will become elevated.

Conversely, space temperature levels will be low during mechanical heating if more outside air is taken in than the system can handle.

Since many of these systems are cycling heating and cooling while continuously running a supply air fan, excess outside air will cause additional discomfort during periods when the system is not conditioning the air.

In addition, systems with CO_2-based demand controlled ventilation will often over-ventilate as a result of assumptions made on the CO_2 production rate of the occupants and measurement uncertainties of space and outdoor CO_2 levels.

Providing the proper intake flow rates, or providing an alarm when intake flow rates are not maintained, will improve the temperature and humidity performance on small packaged units.

Dilution Ventilation for Acceptable IAQ

Poor IAQ occurs when the outside airflow rate is less than that required for proper dilution.

Proper dilution ventilation is paramount to acceptable IAQ for occupant productivity and well-being. Lawrence Berkley National Labs (LBNL) has done an outstanding job quantifying the economic gains of providing acceptable IAQ. In a recent study, their findings indicated that improving IAQ by providing proper rates

of outside air could have an economic benefit more than 200 times that of the additional cost of energy to condition the air. When all is considered, a 5 ton unit serving an office space with 14 people (using ASHRAE's default occupancy of 7 people per 1,000 square feet) could have an economic gain of $11,200 each year if the average salary of the office was $40,000 and a conservative 2% annual productivity and health gain was realized.

Airflow measurement can pay for itself in productivity gains, especially if damper binding or actuator slippage results in under-ventilation, a condition which could go undetected for years. In addition to productivity gains, under-ventilation can result in improper pressurization and unacceptable indoor air quality as a result from inadequate ventilation and subject the owner to unprecedented liability exposure.

Energy Efficient Operation

Clearly a system cannot operate efficiently if the outside airflow rate during periods of heating or cooling exceeds the equipment's ability to condition the air properly. This is another bottom-line affect that can go undetected for extended periods without proper monitoring of intake flow rates.

Low Maintenance Operation

Low maintenance operation efforts will be foiled if outside air intake flow rates vary significantly from set point. Excess outside air will create excessive maintenance load on a system. Inability to maintain space temperature and/or humidity levels (from too much outside air or negative pressure) will result in the system running more than required during optimal operation. More operating hours equals shorter operating lifetime. During high dew point periods, excessive water carry-over from cooling coils can create cooling coil and drain pan maintenance problems. High humidity in the space can damage walls and ceilings as well as promote a favorable condition for mold growth. High outdoor air intake flow rates when outside air temperature are cold can result in coil freeze events or halting of system operation from freeze-stat protection causing damage to the building or at a minimum, greater work load for the facilities maintenance team.

Once again, airflow measurement with alarm capability can significantly reduce the overall maintenance costs associated with these small air handling units.

Conclusions

Small packaged units are relatively inexpensive. As a result, sensors and controls to ensure proper operation are often not provided. Outside air intake flow rates above or below operational requirements can result in a significant expense to an owner as a result of increased energy and maintenance costs or decreased productivity and health. Both LEED and ASHRAE acknowledge the effect of improper intake flow rates and recommend, at a minimum, measurement and alarm on many systems. Based on the undisputable evidence that improper intake flow rates will create significant problems, monitoring and alarming outside air intakes should be implemented on all packaged units. ■

Feature on NEBB Firms

TAB at an Air Force Base

TAB Engineering LLC., has worked on many prestigious projects. One of their showcase projects is working on a C-17 aircraft hangar at the Hickam Air Force Base. The building was big enough to spray paint planes – a huge space. The project involved heavy duty ventilation supply and exhaust fans designed to dilute and exhaust the toxic corrosion inhibitor fumes to protect the maintenance staff as they serviced the planes.

Ryan Chang, Owner, TAB Engineering LLC. He is a NEBB Certified Professional in TAB, Sound and Vibration, and Building Systems Commissioning.

Helping Clients Achieve Green Award

Adlai E. Stevenson high School in Lincolnshire, IL is the nation's first high school to receive a Gold Level Certification for an existing facility from the U.S. Green Building Council's Leadership in Energy & Environmental Design Program. The NEBB Certified Firm who helped this come to fruition is International Test & Balance, Inc. The high school covers over 1,000,000 square feet and has more than 4,000 students.

Robert J. Dold, U.S. Member of Congress and Waleed William Tarazi, Executive Vice President, International Test & Balance Inc. at the Green Award ceremony for Adlai E. Stevenson High School, IL.

Worldwide Energy Savings Study for a Global Company

Pacific Test and Balance, Inc. provided consulting services to McDonalds Corporation Mechanical Group on a worldwide energy savings research study involving energy usage trending at all Hawaii McDonald's restaurants. They also worked on the Allure Waikiki, a LEED Silver project. Allure Waikiki is a 35-story tower that contains 291 units, each with a private lanai, a recreational terrace, dining, and upscale retail space. Another project is the West Hawaii Civic Center in Hawaii. It consists of a community center, amphitheater, services from 15 County agencies, a Hawaii County Council Chamber and Office of the County Clerk.

Jason Huffman, Owner, Pacific Test & Balance, Inc.

Testing Environmental Systems at the New Walter Reed Center

Metro Test and Balance, Inc., a NEBB Certified Firm, performed Test and Balance for the Warrior Transition Unit at the Walter Reed Center. There are two major structures within this project, the housing, dining and administration building and the treatment and rehabilitation center. "Coordination and access constraints driven by the demanding schedule were the most challenging aspects of this portion of the project,

said Jim Kelleher, VP, MTB. He added, “A challenging aspect of the test and balance effort was addressing temperature control and ventilation needs of the new addition. Building 17 houses many varied systems due to the differing needs and objectives”.

Jim Kelleher, VP, Metro Test and Balance

Focus on LEED = Need for NEBB Certification

Air Balance Hawaii has worked on commissioning on many building projects that help buildings meet LLD standards. Air Balance Hawaii got its first taste commissioning a LEED project back in 2003 to 2005. Case Middle School which is part of the prominent Punahou School was certified Gold by USGBC. The project consisted of a 360 ton ice plant, 8 classroom buildings and a multi-purpose bldg. Cx scope also included plumbing and DDC lighting controls. As an independent TAB firm, you experience a vast difference in designs and become skilled at the Cx techniques during the course of years.

Carey Tomasa, Owner, Air Balance Hawaii

Q&A: Pressure Independent Valve Technology

Tricia Bruenn | Belimo Americas

Precisely what IS Pressure Independent technology?

PI technology such as that incorporated into Pressure Independent Characterized Control Valve (PICCV) combines the function of an automatic balancing valve and control valve into one self-contained unit. The PICCV is designed to maintain stable flow (and thus temperature differential) through a coil despite any and all pressure fluctuations that occur in a typical system with multiple control valves and interactive circuits.

How does PI Technology save money?

PI Technology has been shown reduce both installation and operational costs by:

- Eliminating the need for a separate balancing valve
- Eliminating the labor associated with installing a separate balancing valve.
- Eliminating the need for start-up and routine balancing required in systems with interactive circuits.
- Accurately minimizing flow during low load periods so less pump energy is required.
- Reducing the size of both pumping equipment and piping due to the fact that PI valves help minimize overall flow requirement through the system. Less flow means less friction loss through equipment!
- Helping owners realize the full benefit of variable flow pumping systems.

Is it true that PI valves cost as much as 5 times more than a conventional valve?

No! Clearly a valve that incorporates self-balancing is going to be more expensive than a valve that does not, however it is unlikely that you would encounter such an extreme price difference. In most cases, the savings achieved by applying PI technology will substantially surpass any initial materials cost. This includes the savings achieved through the elimination of a separate balancing valve, additional installation labor, and balancing labor. Most importantly, the goal of PI technology is to achieve more efficient performance over the life of the system so operational savings is continuous.

How do I know I will save using PI technology?

Similar to an Energy Star product, most of the savings associated with PI technology is realized in operational payback. However, both installation and operational savings are frequently achieved.

The most compelling evidence of this comes from a study conducted by Integrated Energy Concepts Engineering of two high rise residential buildings in Florida.

One building was installed with Characterized Control Valves (CCV) and standard balancing valves, while the other was installed with Pressure Independent Characterized Control Valves (PICCV). The buildings were identical in terms of location, climate, size, mechanical design, occupancy, and load pattern. Identical test procedures were followed in both buildings, taking into account Bin hours, break horse power, and kWh cost.

I'm confused by what seems to be conflicting reports on the cost effectiveness of pressure independent technology. How do I separate the facts from the hype?

Certainly different tests yield different results depending on the test procedures. Consistent, side-by-side comparisons are essential for evaluating the effectiveness of one methodology over another. When

presented with comparative reports on PI versus non-PI technology, make sure:

- Testing involves interactive circuits which exhibit pressure fluctuations. After all, these are the systems for which PI Technology was developed. Tests which only look at valve performance in a non-interactive environment do not demonstrate the performance values of PI technology, therefore the data they achieve is misleading.
- Tests incorporate the operation of multiple valves to demonstrate the effect of simultaneously varying differential pressures across multiple coils. This yields results that are more similar to actual systems.
- Tests employ consistent supply air temperature strategies for both PI and non-PI systems. PICCV technology can be used for both fixed or varied set point strategies, and should be compared with systems that employ the same strategies, otherwise the test will not yield a true comparison.
- Variables such as humidity, outdoor air requirements, and varying loads are accounted for within the testing procedure.

What is the significance of Delta T when it comes to evaluating valve performance?

For optimum efficiency, control valves should maintain consistent Delta T across the coil that is at or near design, regardless of pressure fluctuations in the system. If the design Delta T is 12° but 6° of differential is being achieved, then energy (and money) is being wasted. This is where PI saves. As independent testing has shown, PI technology consistently maintains high Delta Ts despite varying conditions.

Do all systems require some sort of balancing?

Virtually any system with multiple, interactive circuits require start-up and routine balancing-even those that are considered to be "tightly" designed. There are two main reasons for this:

First, mechanical systems are rarely designed to perfection. Most are designed (or updated) with one or more of the following imperfections: inappropriately sized coils, oversized pumps, improper piping. All of these items lead to pressure fluctuations which impact overall performance and efficiency. Therefore balancing (and rebalancing) is necessary unless PI technology is used.

Second, normal pressure fluctuations in a system WILL occur as a result of constant load changes due to outdoor air temperatures, humidity, building occupation, etc.

While there has been some investigation into the viability of pressure dependent systems that do not employ balancing, we do not consider this realistic alternative for buildings with multiple, interactive circuits.

Where can I find reliable, scientific data comparing PI with non-PI Technology?

Two excellent resources are available on the PICCV web site: www.piccv.com

- A technical paper summarizing the test results of a comparison study conducted by Integrated Energy Concepts Engineering.
- An Analysis of the Iowa Energy Centers Independent Testing of the PICCV. ■

SAVE THE DATE:

2012 NEBB Annual Conference

April 26-28, Disney's Grand Californian Hotel & Spa
Anaheim, California

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