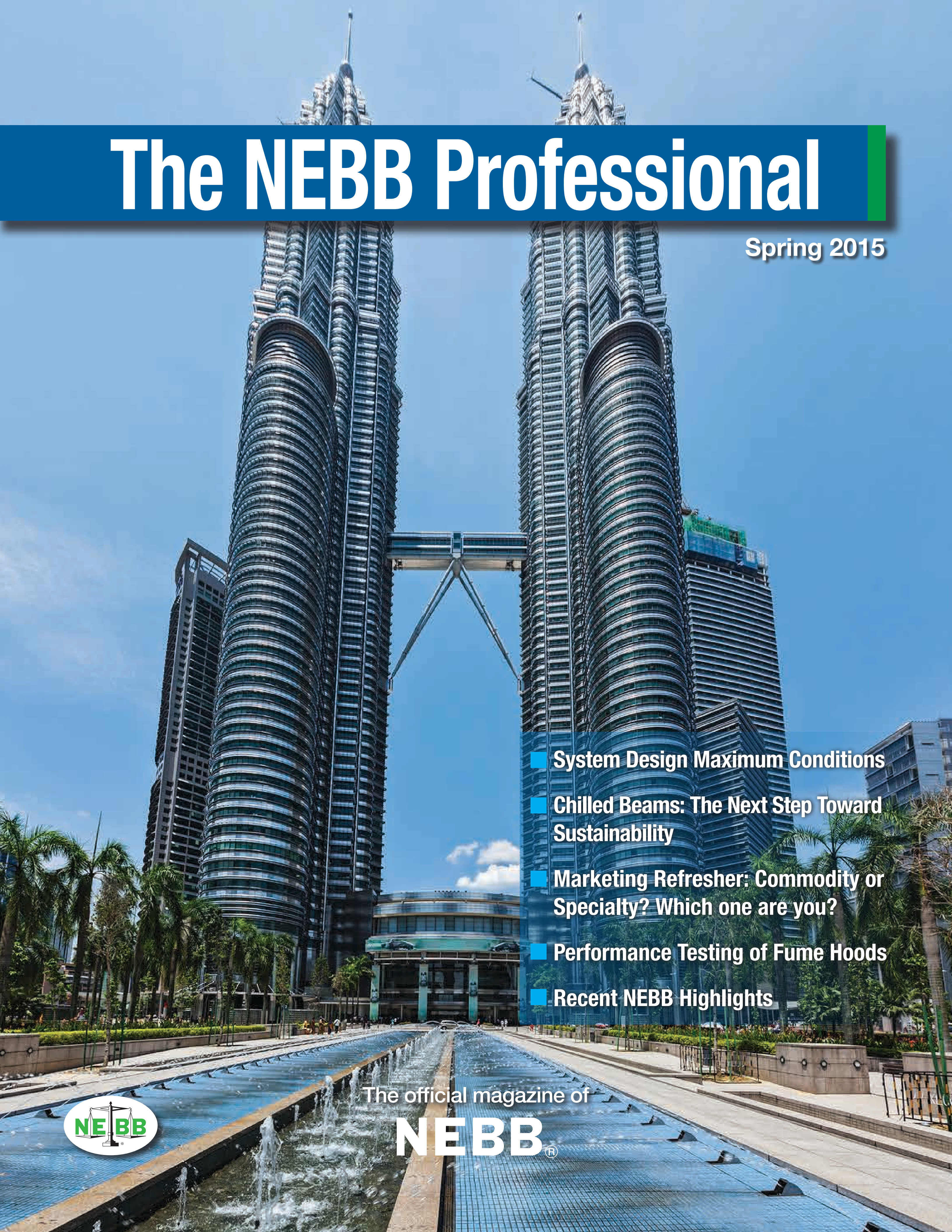
The NEBB Professional

Spring 2015



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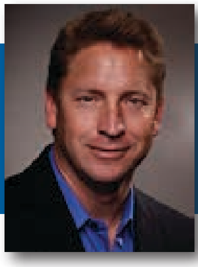

Letter from the NEBB President

We all think we are smart. In fact, we spend a lot of money in order to prove to the rest of the world just how smart we are. Think about it: we have on-line examinations we can take to prove our knowledge, and then we have practical exams we can take to prove our abilities. So let me ask you a question: How do you find out what you don't know? I sat down with my pen and paper to make a list of the ways in which you can figure it out.

Volunteer.

That's it; that's the list. If you really want to find out how smart you "aren't", try spending some time with the best and brightest of our industry by serving on a NEBB committee, board or council with your peers. I have been volunteering in our organization for over 15 years, and I can tell you that I am still learning something during every single meeting or conference call I attend. From different ways of testing systems, to tricks and shortcuts for creating reports, to technological breakthroughs, I am always learning something. And here's the best part: as NEBB is growing and improving our organizational structure and programs, there are more opportunities than ever for you to get involved at the national level. For example, The Board of Directors created our NEBB Standards Council in February; this Council is being chaired by Terry Townsend – a former President of ASHRAE and longtime NEBB volunteer. Under the charge of that council will be working groups for each NEBB Procedural Standard, and those working groups are made up of subject matter experts. With the advent of the NEBB Certification Board in 2014, NEBB personnel certifications have now been separated from the technical committees. This means that we now have a different group of volunteers that help to create our exams, and a different group of volunteers who help to create our training and education.

So how can you get involved? Of course, your greatest opportunity to get involved is by attending the NEBB Annual Conference. This is your single best opportunity to meet with NEBB leadership and provide feedback to all of the committees and working group members. More importantly, it gives leadership a chance to meet with you and find the areas you can serve that will most benefit our organization and you.

Here's a quick glance at just a few of the other things we have in the works:

NEBB is currently in the process of becoming an ANSI accredited Standards Developer. This is separate from ANSI accreditation of our personnel certification programs. We hope to have final approval of our developer status in place by our Annual Conference in April.

Our Certification Board has published their NEBB Personnel Certification Program Policies & Procedures Manual. Like many of our documents, this document is still being updated on a regular basis. In addition, the NEBB Board of Directors has updated the NEBB Bylaws. Both documents can be downloaded from the NEBB website at http://www.nebb.org/resources/nebb_governing_documents/

As you were previously notified, the new 8th Edition of the TAB Procedural Standard has been released and takes effect on April 1st. This Standard is a departure from the "should/shall/may" language of the 7th Edition, so it is important that you understand the changes in the requirements of this Standard in order to issue a NEBB Certified TAB report. The Standard is currently available as a download from the NEBB website.

NEBB has been undergoing an internal audit process of all of our Certified Firms, Personnel, and Chapters. This audit and the results will be completed in time for our annual conference in April, and will provide a more informative look into the current makeup of our organization than we have had previously.

Final preparations are being made for the 2015 Annual Conference in Honolulu, Hawaii. If you only attend one conference, make it this one. We have a fantastic location, agenda, and lots of surprises in store for you, as well as some great training and certification opportunities. Our location this year has given an opportunity for many of our more remote NEBB family to attend, especially those from NEBB Australia and the southwest rim. Most importantly, we are probably in the most transformative time of NEBB's existence; the shift in the way we develop and deliver our Standards, examinations, certifications and training programs is a departure from the way these programs have been delivered in the past. This is your greatest opportunity to gather in-depth information, provide feedback, and have your specific questions answered.

In closing, 2015 is a very busy year for NEBB. There are many moving parts that need to be synchronized simultaneously, and we know that has been frustrating and confusing at times. As we move into the spring, it is truly a time of new birth for NEBB. Growth and reformation is never easy, but I am more confident than ever that the strategic direction and all of the work of the past five years is finally coming together.

Aloha.

Jim Huber
NEBB President

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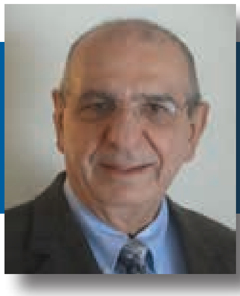
System Design Maximum Conditions

Leonard Maiani | NEBB Technical Director



The NEBB TAB Procedural Standard dictates that all final tests of systems must be tested under maximum design conditions. This requirement applies to air as well as hydronic systems. This requirement has been misconstrued by many technicians and Certified Professionals, resulting in incorrect data being documented in their certified reports.

It is not my intention to itemize every type of system and define the correct setup for final testing. Instead, I want to go through the thought process involved in arriving at the correct posturing of any system, air or water.

The simplest approach to making this determination is to mentally construct the worst possible scenario for a system or component to operate within the design parameters. No more, no less. You may need to confer with the design engineer on any system that defies logic... in your estimation. Some specifications require a pre-balance meeting between the TAB firm and the design engineer. If this is the case, make certain that you have reviewed the contract documents and individual control sequences thoroughly. Doing so will go a long way towards understanding the designer's concept and will give you the opportunity to list all the questions you may have regarding any nuances in the design that you do not understand.

The contract documents may have a very specific requirement for testing any given system and you will be required, by contract, to follow the specifications.

So, just what determines maximum conditions? Assuming that the construction documents do not delineate what constitutes "maximum design conditions", the NEBB TAB Procedural Standards will be the basis for this determination.

Section 8.2.1 of the April 2015 8th Edition of the NEBB TAB Procedural Standard states the following:

> *8.2.1 PERFORMANCE PARAMETERS*
> *Each type of HVAC system is designed to meet a set of performance parameters. This usually includes maximum heating capacity, maximum cooling capacity and ventilation effectiveness. Prior to the TAB process, the CF should normally set up a system to its 'full load' condition (or maximum capacity). The full load condition presents the greatest challenge to a system's capacity meeting its design air flow requirements.*

One of the leading misconceptions is that systems and/or components are to be tested in their wide open position. In actuality, each system or component should be tested at its **design maximum** condition, meaning that the system or component is controlling to the capacity it was intended to operate at. For instance, a VAV air handling system should be tested with all terminal units operating at their design maximum AIR FLOW (not wide open). The system should also be postured to mimic a full cooling condition. If systems are designed with a free cooling cycle (economizer), the mixing dampers should be in their minimum outside air position. This could be referred to as its "worst case" condition or full cooling. If this system has built-in diversity where the total maximum air flow of the terminal units is greater than the air handler design, a number of terminal units will need to be place in their minimum air flow position. The total of all the terminal units must not exceed the design of the air handler for the final measurements to be meaningful. The report Summary should document the VAVs that were placed in the minimum position.

If the system is equipped with a return/relief fan, the worst case for this fan is usually determined by its performance when in the full relief mode due to the resistance of the relief duct work and relief louver. This mode typically will impose the highest total static pressure on the fan. Once the capacity of this fan is established to meet design air flow, it would then be placed in the return mode (series with the supply fan) and an adjustment to impose sufficient back pressure will need to be applied to match the performance in the relief mode. The use of fan tracking and controlled air flow measurement should solve this difference, but if it doesn't, adjustments to return damper stroke or adjustment of a manual damper, if provided, will need to be made to assure the same air flow in both modes.

Single zone systems should follow the same rule of testing the system in what would be the full cooling mode, or minimum outside air. Some specifications may require reporting the final test results in both modes, which is important for the TAB professional to do even if it is not specified. This verification of both modes may be key to uncovering unforeseen issues that could eventually negatively affect system performance.

After determining if you have separate fans for hot and cold decks, or a single common fan, dual duct air handlers with a common fan would be tested with terminal units in full cooling. Both decks should be traversed to pick up any hot deck leakage. Systems with separate fans should then be tested in the full heating mode to provide "worst case" conditions for the hot deck fan. The return/relief fan would be tested as described for the single duct VAV system.

Multizone systems would be tested with all zones calling for cooling with the mixing dampers in the minimum outside air position if equipped with an economizer cycle.

One item not to be overlooked is filter loading. Many specifications require artificially loading the filters to 50% or some other criteria. It has been my experience that the contract documents don't list what the maximum allowable filter loading is. It is the TAB firm's responsibility to contact the design consultant to find out what pressure drop was used in this calculations. In some cases, especially when a substitute air handler is selected, the new fan curve may not provide the same AIR FLOW vs Static Pressure relationship as the unit that the design was based on.

When no filter loading is specified, the final readings should be documented with clean filters.

In cases where any attempt to load the filters, as specified, results in undesirable performance, a description of the situation needs to be included in the report Summary. An example of what can happen (from my experience) was a system equipped with HEPA filters, designed to have an allowable loading of 1". In actuality, loading the filter to 1/4" resulted in a 50% loss of air... to a surgical suite. Bringing this to the Owner or design consultant's attention can avoid some serious problems for the Owner.

Exhaust systems should be tested with the intended make-up air operational and, where applicable, variable flow hoods operating with their sashes in the appropriate positions for maximum design air flow.

Smoke control fan testing should be confirmed with the design engineer even if the sequence seems to make sense. An engineered system will have requirements to meet life safety codes and there can be no misunderstandings.

Hydronic systems are usually not as complex as air systems, but attention to what constitutes a "worst case" situation is just as important.

Like air systems, you must determine whether there is any diversity designed into the system and, when there is diversity, the setup of the system will require that X number of valves be opened to 100% with the remainder of control valves closed. I won't go into the method of balancing systems with diversity, just the final system/pump tests.

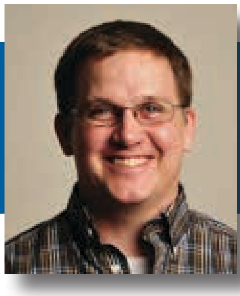
A situation has developed with the use of automatic flow limiting valves in lieu of manual balancing valves. Several manufacturers are stocking valves in the ½" to 1" range with predetermined GPM ratings. In order to be safe, valves with the closest GPM to design (normally above design) are being supplied to the project and usually accepted by the design consultant. Unfortunately, the original pump selected to match the total coil design in the contract documents, but due to the upsizing of the automatic flow limiting valves, the total coil flow exceeds the design of the pump(s). This needs to be accounted for in your setup and the system will need to be configured as though it had diversity, otherwise the demand on the pump(s) would exceed their design GPM. When this occurs, the report Summary should describe the situation, and the coils that were closed for the final test should be documented in the summary.

In the event that you cannot determine the maximum "worst case" and the design consultant's assistance does not provide a clear method, call or email NEBB for professional advice from the Technical Director and your problem will be brought up to the TAB committee for assistance in resolving the posturing of any particular system.

Again, not all system permutations have been covered. The final test results are extremely important in evaluating the performance once the system is ready to be turned over to the owner and should not be taken lightly.

Chilled Beams: The Next Step toward Sustainability

Thomas Rice | Product Manager, SEMCO LLC



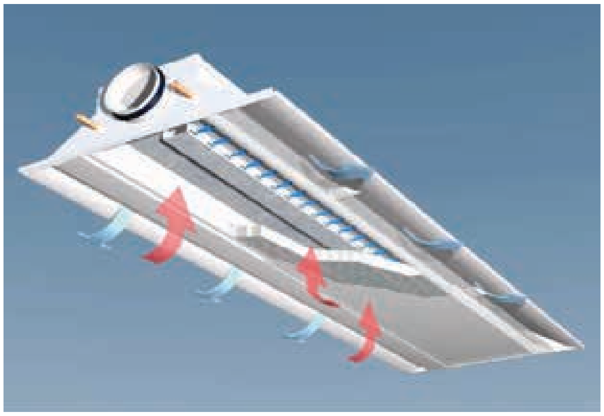
Sooner or later a test and balance technician will be confronted with chilled beams (CB), one of the HVAC industry's newest sustainable technologies American engineers are specifying for energy-efficient commercial building projects.

CBs have been used in Europe for decades, however the technology is now getting specified in many North American offices, schools and other facilities.

Simply defined, CBs are coils mounted in a ceiling grid, hard ceiling or as a hanging pendant fixture. They are available in varying lengths that fulfill most indoor climate needs by delivering ventilation, cooling and heating. They mix very well with room ambient air and provide comfort via low air velocities in the occupied zone.

When properly designed, installed, tested and balanced, CB systems deliver a comparatively superior indoor air comfort alternative of temperature and humidity than more conventional systems such as variable air volume (VAV) or chilled water loop/fan coil or rooftop DX systems.

Equally important as comfort, a reduced HVAC fan-related energy consumption of approximately 50 percent is possible with CBs versus the aforementioned conventional system methodologies. For that reason, they rank highly as a green technology for Leadership in Energy and Environmental Design (LEED®) and other best practices projects.



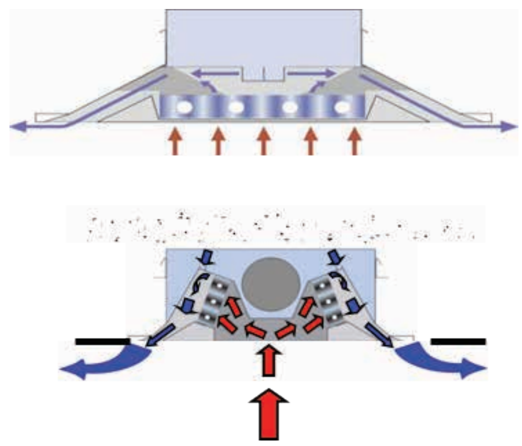
How a CB Works

The theory is that the beam discharges primary air at a high velocity pressure. The discharge and pressure is "behind" the cooling coil, creating a negative pressure that induces recirculated air from the space through the coil that resides in the beam. The principle function is the beam induces a typical 5:1 ratio of air without the addition of fan power. 0.5 inch of pressure on 100 cfm input would yield 600 cfm of total circulation within the space. So it is similar in concept to a diffuser, but has a localized coil for comfort cooling/heating in the induced air created by the primary velocity pressure.

With regard to energy standards, a CB system can surpass the minimum requirements for ASHRAE 90.1, "Energy Standard for Buildings, Except Low-Rise Residential Buildings," by 30 percent or more. In LEED projects, a CB system--especially when combined with dehumidified outdoor air for humidity control-- can play a larger role in earning all the credits available in the "Energy and Atmosphere Credit 1: Optimize Energy Performance" section of a platinum-certified project. That eliminates guesstimating whether the building's HVAC design has enough built-in performance for LEED and other green programs.

Passive and Active CB Types

There are two types of CBs–passive and active. Both methods have ½ inch-diameter fin/tubing coils supplied by a chilled water loop, thus the CB's coil



cools via induction that envelopes the occupied zone. While both passive and active CBs have the primary air system to handle a space's latent load, only the active chilled beams have a forced air component, which makes them suitable for both heating and cooling.

Typical CBs range in size from 2 x 2 to 2 x 10 feet long and have a hinged access grill that aesthetically conceals the coil, water connections, air nozzles and outdoor air supply duct fittings (on active models).

Passive CBs are installed as pendants or flush in-ceiling versions. Therefore, ceiling-mounted models use the space between the drop ceiling and the structural ceiling as a plenum to draw air naturally into the coil chamber. This simulated chimney effect creates a constant circulation, but at a very gentle flow rate without the drafts of VAV, fan coil or rooftop systems. To facilitate the chimney effect, conventional square, rectangular or more aesthetic linear grilles must be mounted in the ceiling to facilitate room air rising and entering the ceiling space plenum from which passive CBs draw.

Active CBs are decidedly different. Currently, active CBs command more than 90 percent of the North American CB market. They require a small amount of airflow ducted with a 6-inch-round take-off from a dedicated outdoor air system's (DOAS) supply duct, or another conditioned air source, for satisfying ASHRAE-62 outdoor air standards. While passive CBs use convection, active CBs use convection and induction to distribute cooling evenly throughout the space. The dehumidified air from the primary air system allows the beams to run dry, eliminating the need for filtration as well as drain pans and condensate lines. The induction air gives active CBs a minimum three times more performance capacity than their passive counterparts, although they may both be the same physical size.

Outside air flow to an active CB generally ranges from 80 to 100 cfm, but because the warmer air in the space rises and is cooled again, the CB is actually handling a 5:1 ratio resulting in a total volume of 400 to 500 cfm. Average throw distance is 12 to 14 feet out of either or both sides. This displacement strategy is emphasized because as the air disperses out of the adjustable slots (also referred to as nozzles) a negative pressure is created that continually pulls air across the cooling coil.

Because CBs handle all of the space temperature control, dehumidified outdoor air may be all that's needed to satisfy ASHRAE 62.1 outdoor air requirements in heavily occupied spaces, such as classrooms. However, variable air volume (VAV) or more conventional fan coil systems or other constant flow air systems can also be used as a back-up to supply air, especially in lightly occupied spaces such as offices. However these air systems are supplemental and require considerably less airflow, because the CB's and the outdoor air requirement can handle the majority of temperature set points and require typically 50 percent the total air volume of the conventional approach.

Testing and Balancing for CBs

There are three major considerations when testing and balancing a CB system.

- Is an appropriate amount of water going to the CB?
- Is the proper amount of primary airflow getting to the active CB?
- Is the slot position and pressure correct for the amount of induction?

Waterside Balancing

Both passive and active CBs typically have a hydronic circuit limit switch or circuit setter, that can be provided by CB manufacturers, to balance the water flow, typically at up to a two-gpm rate. Generally, water flow should either be on or off, because a modulated flow will many times prematurely wear a zone's control valve. Furthermore, the water flow in a particular zone is relatively small in comparison to more conventional approaches.

One mistake that can cause water flow noise and water velocity issues is the wrong take-off piping size. Typically connections might reduce down from ¾ inch diameter pipe to ½ inch. Installing a ¾ inch valve to control water flow can increase velocities for which the CB was not designed if it's closed partially. Instead, using a smaller valve that matches pipe velocity will create less subsequent water flow noise.

While NEBB may require circuit setters on every CB, some manufacturers recommend a circuit setter per every set of four to six CBs.

In a scenario where a room has more load than anticipated, another advantage of CBs is that adding one unit requires no electrical, minimal ductwork and piping, and the total labor is less than a fan coil addition.

Airside Balancing

Passive CBs don't have ducted air flow. The primary air sent to the space that uses passive CBs is direct to the space. Therefore airside balancing would be similar to any conventional direct-to-space air delivery system.

Airflow pressure testing in active CB applications confirms what the room is required to receive according to the engineer's specifications. Airflow pressure testing is best accomplished at the primary air supply inlet to the CB. The cfm could range from 50 cfm for a small room to 100 to 200 cfm per CB in a large room with many cubicles. It all depends on the number of CBs in a given space and how the engineer's design offsets the heat load. The engineer determines the load, but the manufacturer supports the engineer with a recommended design criteria consisting of airflow, size and number of CBs to meet that load and airflow distribution.

Some active CBs have adjustments for up to 12 different field-adjustable air flow directions and volume combinations, while others have fixed slots with pressures that can be varied only after significant induction modification. Field-adjustable slots offer

flexibility because their adjustment will change the amount of induced air to align the CB with room specific needs once actual loads are realized.

The fact that some slots are field-adjustable is many times missed in the test and balancing stage. In one example of a space complaint providing an air supply of 77°F with an active chilled beam, the slots were completely open instead of set for room specific requirements per the submittal. Under direction of the manufacturer, the installing contractor adjusted the slots down 75 percent resulting in a temperature reduction to 74°F in five minutes. Some discharge designs can offer the flexibility of shutting off one side, both sides, or directing air strategically to room warm spots.

Generally, an active CB grouping will require approximately half the airflow of a conventional forced air duct system, thus cutting fan motor horsepower to approximately 50 percent for a significant overall energy savings. This energy savings is combined with a better overall occupant air comfort, because it's quieter, less drafty and provides a more stable temperature than conventional methods. The estimated 50-percent fan power energy is augmented by the savings provided by enthalpy recovery and passive dehumidification application when combined with the dedicated outdoor air approach.

While the international trend is toward active CBs, there are still special applications where passive CBs are strategic, such as a supplement to under floor air distribution (UFAD) systems. UFAD already handles the bulk of the space sensible load, therefore a passive CB can add extra cooling in hot spots, such as peripheral areas with thermal degradation, solar gain or a core load with a significant temperature load.

The Four Loads of a Building

All buildings are affected by four loads:

- outdoor air temperature
- outdoor air humidity
- space temperature
- space humidity

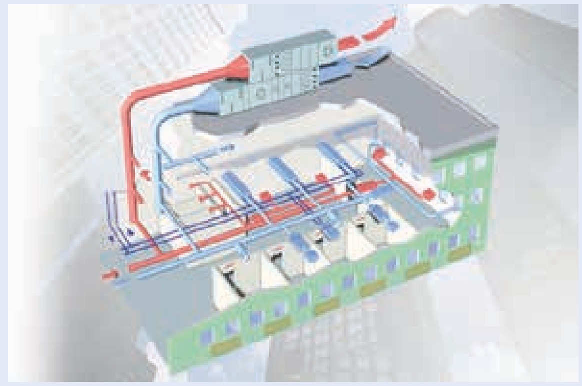
Unlike the two most common methods of cooling/heating commercial buildings-- chilled water loop/fan coils and rooftop systems with variable air volume (VAV) boxes--a CB/DOAS combination is the method that handles all four building loads with the lowest operating costs and the best indoor air comfort. A third method available in commercial buildings is the rooftop systems with ductwork, but because of its higher energy use, it typically isn't a potential candidate for building projects targeting long-term, energy savings.

Although a CB/DOAS offers the greatest energy savings, some engineers tend to stay with the perceived "safer," more conventional equipment. However those strategies may not provide the building owner with the best energy savings, indoor air comfort and investment.

A VAV system air handler, for example, is a one-dimensional method expected to control four building loads. The expensive part of the process is cooling air to 50°F for removing moisture, then using a gas-fired or electric heating source for reheating the air to 68-72°F to avoid over-cooling the space to satisfy the set point temperature. Over-sizing the air handler's coil and other components to satisfy all four loads requirements is also expensive in upfront capital and operating costs. A VAV system handles space temperature and humidity quite well, but at a comparatively higher cost than CB/DOAS, because of fan power.

The VAV strategy is especially expensive when cooling isn't needed. The air volume is decreased, resulting in sub-par air distribution while the and the air must still be cooled to 50°F and then reheated.

Fan coil systems with a two-pipe or four-pipe loop are particularly efficient in satisfying all four building loads, because they're based on providing cooling/heating to only the zones that need it. The fan coil system with a supplemental DOAS is a two-dimension method that increases this method's efficiency with all four building loads. These systems can potentially handle space temperature and humidity very well mechanically, but many times satisfy the temperature before humidity levels are reduced to an optimal range for comfort. When the coil satisfies space temperature, the unit shuts down and residual condensed moisture evaporates back into the space. Under-sizing the fan coil will result in higher energy costs because of longer run-times, although that would improve humidity control.



One remedy to these balancing challenges is creating multiple positions on the fan, or situations where they create "mini VAV" boxes to attempt increasing run-time for total humidity control.

Balancing these systems is possible, but it can be very controls-intensive. For example, if the temperature is sufficient, but humidity is higher, then a discharge of lesser air volumes at lower dew points will handle more humidity without over cooling the space.

A CB/DOAS combination also handles all four building loads, but at a lower cost than the other methods. The DOAS handles outdoor air temperature and humidity, and is sized to handle all the space humidity. The DOAS typically delivers outdoor air at a room-neutral temperature of approximately the high 60's or low 70's through the active CB's air discharge. The DOAS dries the space without over cooling the space, which is the cost-intensive challenge of the other two methods.

The remaining building load of space temperature is handled with room thermostats controlling CBs. The CBs concentrate solely on space temperature because the space humidity is already handled.

The CB/DOAS combination's inherent ability of efficiently controlling humidity and temperature must be recognized and adjusted accordingly to the building type. For example, a school and office have decidedly different requirements. A school requires more outdoor air and subsequently a higher temperature load because of the higher ventilation and occupancy. An office typically has comparatively less occupancy, thus it needs less outdoor air. However, an office has higher heat load due to more task lighting and electronic equipment. These differences can be handled easily with a CB/DOAS combination, but to realize those savings, qualified testing and balancing is needed.

Passive CBs can also appear with active CBs in the same room design especially near southerly windows, computer electronics areas or other hot spots. Since passive CBs don't require outdoor air, they offer an advantage in retrofits and cooling improvements.

In the example of a 10 x 10 foot office requiring a ½ ton of air conditioning, a southern exposure window might be 1,000 BTUs of heat gain. A single 2 x 6 foot CB may be able to handle 5,000 BTUs of cooling, being short by the window's 1,000 BTU heat gain. In lieu of the addition of primary air, adding a passive CB to handle the extra load is more cost effective as it doesn't require air ducting because the existing 2 x 6 foot active CB already supplies the required outdoor air. Supplemental piping to the passive CB would be the only cost for adding cooling output.

The DOAS Factor

A basic DOAS is defined by ASHRAE as an enthalpy wheel unit with mechanical cooling and hot gas reheat, however the components, functions and methodology can differ widely by manufacturer.

A DOAS can be defined as a system that turns outdoor air into space air, or conversely, that the outdoor air load is eliminated from the space comfort cooling devices. This decoupling approach allows for a more stable operation of the building, as the outdoor load varies widely, the space devices can focus on their load. DOAS can be single wheel as defined by ASHRAE, dual wheel with a sensible reheat, or dual wheel dehumidifier with supplemental dehumidification coming from a second desiccant wheel. The trend is to handle the latent load first, so DOAS systems that deliver dry enough air to handle the indoor humidity load are fast becoming the preferred system in a decoupling approach – outdoor air and space humidity.

Conclusion

If the three aforementioned adjustments-- water flow, airflow, and slot or induction air dispersion-- have been made without alleviating the problem, then a load problem is most likely due to misapplication, miscalculation or repurposing.

If the design or construction team missed the calculation somewhere along the process, the beauty of CBs is their flexibility and easy modification. If a room was designed for 10 people and the owner later decided 20 people would reside in a workspace, rerouting ceiling ductwork in a conventional ventilation system would be costly. With a CB system however, a passive CB could be added with just a simple cold water loop hook-up. Or a new active CB could be installed with 50-cfm of outdoor air routed to it via flex duct from a nearby CB, in addition to valves and a piping take-off from the chilled water loop. The room is still getting the prescribed cfm of outdoor air, but now additional air conditioning tonnage is being supplied.

Test and balancing technicians should familiarize themselves with CB technology, because an increasing amount of systems are currently being specified by engineers looking for a competitive edge with their green designs that meet ever challenging efficiency requirements. ■

Commodity or Specialty? Which one are you?

By David Kirkham, NEBB Marketing Committee

Within the past two years, I've seen two local guys in the industry attach themselves to four different corporate entities. They worked for one, moved to another, started their own, and then started a second one of their own. Yet, in all of that hopping around, they never took a moment to understand the difference between a commodity and a specialty. How do I know this? Because at each juncture they subscribe to the old mentality of "low bid gets the job". In case you haven't noticed, times have changed.

While my far removed comrades continually perceive this industry as a commodity they neglect to recognize it as a specialty. Although the afore mentioned have yet to learn from this distinction, I believe that those attuned to this industry may benefit from a brief discussion of the differences between a specialty and a commodity.

Whether you're old school and choose to compromise the spine of a Webster's dictionary or you are new school and instinctively Google it, the results will be the same.

> *Commodity: an article of trade or commerce, especially a product as distinguished from a service.*

> *Specialty: a special or distinctive quality, mark, state, or condition.*

The next natural question (actually two of them): Which one of these two are you? And more important; which do you want to be? The question was combined because the obvious answer is the same; As a NEBB Certified Firm, you are a specialty. Let's discuss how to get some mileage out of that revelation.

If you look back to the Spring 2014 edition of The NEBB Professional, there is a wonderful article written by the NEBB Technical Director, Leonard Maiani. Leonard shares a story about a representative asking him about the necessity of balancing. In the last paragraph of the article, Leonard states;

> *"There are good TAB firms and there are GOOD TAB firms. You must be aware that every TAB firm is just selling you time and integrity. Low bid will get you the company who will spend the least amount of time on the job. I, for one, would not recommend selecting a TAB firm on a low bid basis."*

The TAB firms are the commodity, and the GOOD TAB firms are a specialty. If I had to delineate the differences between the two, I would go with this:

Activity	TAB Firms	GOOD TAB Firms
Securing Work	Bid Basis	Negotiated
Certifications	Quickest and Easiest	Nationally Recognized
Scope of Work	To the letter; nothing more	Complete Systems
Continuing Education	Minimal as required	Constant
Diversity	Test and Balance	Multiple Disciplines

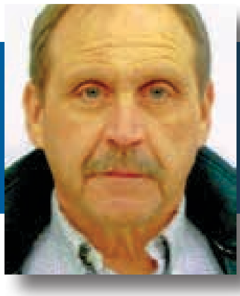
The key here is to wrap up everything in the right column, put a bow on it, and present it. Feel free to use this to help increase your breadth and depth in this industry.

"We are a NEBB Certified Firm. This means that we develop relationships whereby we can incorporate our knowledge of the industry in order to help you to negotiate projects with the inclusion of a nationally recognized standard. We address complete systems on a project; not just the minimal amount required. We are constantly honing our skills and adding to our knowledge base which will ultimately be a benefit to all involved in this project. Our established skill set is diverse. Regardless the project, we can contribute to a positive and advantageous condition that transcends the minimalistic approach."

NEBB Certified Firms are much more than TAB firms/Commissioning Firms/Building Enclosure Testing, Retro-Commissioning/Cleanroom Performance Testing/Fume Hood Testing/Sound Measurement/Vibration Measurement Firms.

NEBB Certified Firms are partners…and a specialty.

Performance Testing of Fume Hoods



Don Fedyk | Chairman, NEBB FHT Committee

One of the major concepts behind the Performance Testing of Fume Hoods is providing a safe and productive environment when working with hazardous materials. While there are numerous containment devices in use in the modern laboratory, the fume hood has been designed to protect the user, whether a new student or an experienced researcher and is why we, at NEBB, have stressed the proper protocol for verifying the containment of this specialized vessel.

Under the NEBB FHT Procedural Standard, like the ASHRAE-110 Method of Testing (MOT) of Fume Hoods, the major premise is to verify the actual performance of the fume hood and the containment of this safety device. One must also realize that a fume hood, while specifically designed and carefully built, is an extension of the exhaust system. The fume hood is dependent on the exhaust serving it as well as the laboratory environment in which it is located. When fume hoods are tested in the "factory", it usually means one hood of each model is tested in an ideal laboratory condition unlike the majority of labs where they are eventually installed and used.

The field testing of fume hoods, is verifying the operational performance where the device has been installed and either being or will be used. This is where the NEBB TAB Certified Professional validates the performance of the supply, exhaust, and/or return units and devices to the requirements specified for that space. It is only after completion of all other trades; such as, Electrical, TAB, Controls, etc., are completed that performance verification should be completed. It is at this point that each fume hood should be tested under the full performance standard as specified by NEBB FHT or ASHRAE-110 MOT, verifying the safe installation and operation of each PPE. Remember a fume hood is Personal Protection Equipment.

In my over 25 years of testing fume hoods utilizing the NEBB FHT Procedural Standard or ASHRAE 110 MOT, I have found a very common misunderstanding of the test protocol. The face velocity of a fume hood is not an indicator of containment! In ANSI/AIHA Z9.5 – 2012, there is a recommendation of face velocity range of 80 – 120 fpm for a standard hood but that is a recommendation. There are some local government agencies, universities, etc., that have specific velocity requirements but there is lack of scientific confirmation of the validity for these. Uniformity of the velocity across the sash plane is an indicator of even airflow but again does not confirm the containment of the fume hood. The face velocity average and the readings are a baseline of the hood performance and should be used to confirm operation of the hood during future tests. Just as visualization testing, either small or large challenge, help verify the direction of airflow and evenness of the draw, it is not a quantitative

method of evaluating the containment performance of a fume hood. The tracer gas portion of the testing verifies not only the containment of the fume hood but the operation of the system and laboratory.

Over the years I, my company, and NEBB, have found numerous cases of fume hoods meeting the face velocity and visualization tests only to not meet containment specifications when tested with the tracer gas. While there has been a growth in testing of fume hoods due to Standards; such as ANSI/AIHA Z9.5, company policy changes, and increasingly because of insurance requirements, there has been circumvention of the tracer gas containment test due to the misunderstood notion that velocity = containment.

During the testing of fume hoods at a recent project, previously tested for face velocity and visualization with an affixed label, we found all hoods met the face velocity indicated and from the visualization testing seemed to contain, but all exhibited extensive leakage during tracer gas testing. Readings were greater than 10 Parts per Million (>10 PPM) where the recommended value is (<0.1 PPM). From this we were able to determine that these labs contained numerous issues that were causing the problems. First, the fans were in the lab area above the ceiling, discharge (positive) ductwork installed above the ceiling the lab, discharge through wall without adequate velocity, and open windows. Each of the issues noted can and did cause an unsafe condition in the laboratory environment and most, if not all, disregard the recommendations in Z9.5 or best practices for a lab environ. During the testing of a chemical facility quality assurance laboratory again the face velocity and visualization testing was not indicative of the leakage from fans installed above the hoods until the tracer gas exposed the recirculation of the discharge of the hoods back into the laboratory.

Tracer gas testing for the sash movement has helped uncover unsafe conditions like utilizing a variable volume system with a bypass fume hood which is used for constant air volume operation or a restricted bypass that was too large. This same testing can either confirm or disprove the proper fan or VAV operation. During testing of a number of fume hoods at a university chemical laboratory, we found very good containment during static mode testing but a dramatic rise during the Sash Movement Effect (SME) testing on some of the hoods. Further investigation found a rather common malady. Even though the terminal units were pressure independent air valves with one-second reaction, system static pressure was too low due to energy conservation design to properly react quickly enough causing a delay in system response resulting in a surge of gas escaping from the hood.

Tracer gas testing is an essential portion of the NEBB Fume Hood Performance Testing and should be performed on all newly installed fume hoods, hoods that area modified, moved, etc. The Federal Government, through OSHA and other regulations, has put the liability for the health of the laboratory workers and anyone else that may be harmed, on the owners/operators of the laboratories. While we have laws, standards, and guidelines along with many scientific studies confirming, good old plain common sense dictates that initial Performance Testing of fume hoods, Velocity, Visualization, and Tracer Gas, along with continuous monitoring provides the best individual protection and a safe working environment. ■

Recent NEBB Highlights

NEBB Roundtable Topic at Hawaii ASHRAE Chapter Meeting

ASHRAE Hawaii Chapter's November meeting was held at the Plaza Club Honolulu. The meeting topic was Testing, Adjusting, Balancing Roundtable, and the 3 speakers did a great job reinforcing the values of NEBB and sharing interesting points about our profession. Steve Smith, President of the Northern California/Hawaii NEBB Chapter was one of the speakers. Ryan Chang, a NEBB Certified Professional with TAB Engineers, LLC was the moderator for the event.

Ryan Chang

Steve Smith

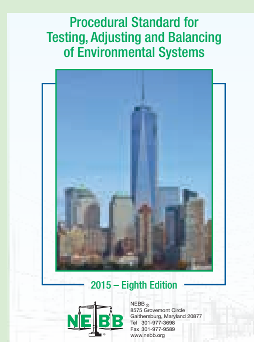
Last Call! 2015 NEBB Annual Conference: "A Sea of Change: A World of Opportunities"

As we celebrate NEBB's 45th birthday, this marks the first time the NEBB Annual Conference is being held in Hawaii. Sessions and Speakers:

- Keynote presentation: Welcome to Your Brain (memory enhancing two-part session) - Bob Gray
- Dead Man's Steam School - Dan Holohan
- Marketing by Example - Dan Holohan
- Smoke Control Pressurization Systems - John Klote
- Cash Flow Budgeting and Collections - Bill Kinnard
- High Performance Fume Hoods - Bob Morris
- Overview of USP 797 Testing Opportunities and Update to ISO 14644 -1.2 & 2.2- Don Hill and Pat Law
- Seawater Cooling - Principal Differences for Hydronic Balancing - Duke Hartman and John Peterson
- Air Leakage Testing Methods for Commercial Buildings and Ducts - Colin Genge and Graham Finch
- The State of HVAC and BAS Industry - Amara Rozgus
- Pushing the Envelope: Airtightness Testing of Larger and more Complex Buildings - Gary Nelson and Frank Spevak
- Energy Calculations Handbook and Commissioning Testing Handbook - Jim Bochat
- Noise Measurements and Noise Control Concepts - Earl Mullins
- Exploring the Latest Advances in Clean Air Solutions - Lisa Warner

Register today. Details on NEBB website.

Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems, 2015 - Eighth Edition Released



The NEBB Board of Directors approved the TAB Procedural Standard with an effective date of April 1, 2015. Please distribute the updated version to your Certified Professionals, Certified Technicians, and Clients.

The Eighth Edition Standard represents an update from past editions and is the culmination of several peer reviews which was compiled by the NEBB TAB Committee with input from NEBB Certified Professionals and the industry. This document can be ordered from the NEBB Website.

NEBB Certification Board Policy Manual Published

The NEBB Certification Board has published the Personnel Certification Program Policies & Procedures Manual. This manual covers all of NEBB's policies and procedures in regards to personnel certifications.

NEBB In Action

PDC Summit

NEBB exhibited at the ASHE PDC Summit 2015, which took place on March 15-18, 2015 in San Antonio, Texas.

This conference is attended by industry professional with expertise in health care planning, design, and construction. More than 3,200 senior leaders from hospitals, design firms, and construction companies attend the PDC Summit to share perspectives on optimizing healing environments.

NEBB's continued participation ensures that we are keeping NEBB Certified Firms in front of an integrated audience of C-level, design, construction, and operations professionals, each and every year.

NEBB Cleanroom Speech at ISPE Midwest TechEd Day - April 30, 2015 in Kansas City, MO

Don Hill, Chairman of NEBB Cleanroom Performance Testing Committee will be speaking at the ISPE Midwest TechEd Day. He will address Critical Environments Cleanroom Commissioning. The session will cover:

- Defining acceptance criteria.
- Verification that the design has the ability to meet the acceptance criteria.
- Describe how to prove acceptance criteria is met and operational states of the Cleanroom.
- Discussion of applicable standards, ISO 14644, EU Annex 1, PICS.
- Data for baseline operation and use in troubleshooting and evaluation.
- Testing for continued compliance.

NEBB Participation at ASHRAE Winter Conference and AHR Expo

NEBB President Jim Huber and other NEBB Certified Professionals were present at the ASHRAE Winter Conference 2015 and AHR Expo 2015. NEBB representatives included: immediate Past President Bob Linder, Don Hill, Jim Bochat, Steve Wiggins, Terry Townsend, Jim Kelleher, Stan Fleischer, Don Fedyk, Olaf Zwickau, Eric Jenison, Don Hill, Martin Burke, Rob Chopowick, Tom Meyer and Mandy Kaur.

President Huber represented NEBB at the ASHRAE Welcome Party, ASHRAE President's Lunch and other ASHRAE meetings. Several NEBB representatives attended ASHRAE Committee meetings including Guideline 0, ASHRAE 7.9, Standard 202, TC 7.9; SPC 110, Method of Testing Performance of Laboratory Fume Hoods, and others.

As an endorsing organization of the AHR Expo, the NEBB logo was prominently displayed on the AHR website, onsite signage and directory listing. The NEBB Booth received a lot of attention and traffic.

NEBB hosted educational sessions –presentations can be downloaded from NEBB.org– and a networking session on January 26, 2015 at the Convention Center, targeted to customer audiences attending NEBB educational sessions.

President Huber provided a keynote speech to SHASE (Japanese HVAC professionals organization) on Testing Trends in North America on January 25, 2015.

NEBB Co-sponsored the HPBCCC Briefing with ASHRAE in Washington, DC

ASHRAE and NEBB cosponsored the High-Performance Building Congressional Caucus Coalition Congressional Reception on Wednesday, January 7, 2015, for the 114th Congress. This reception provides the industry an opportunity to introduce itself to the new Congress. The NEBB logo was prominently displayed on the event invitations that were sent to 160+ organizations, as well as on all the on-site signage at the reception.

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