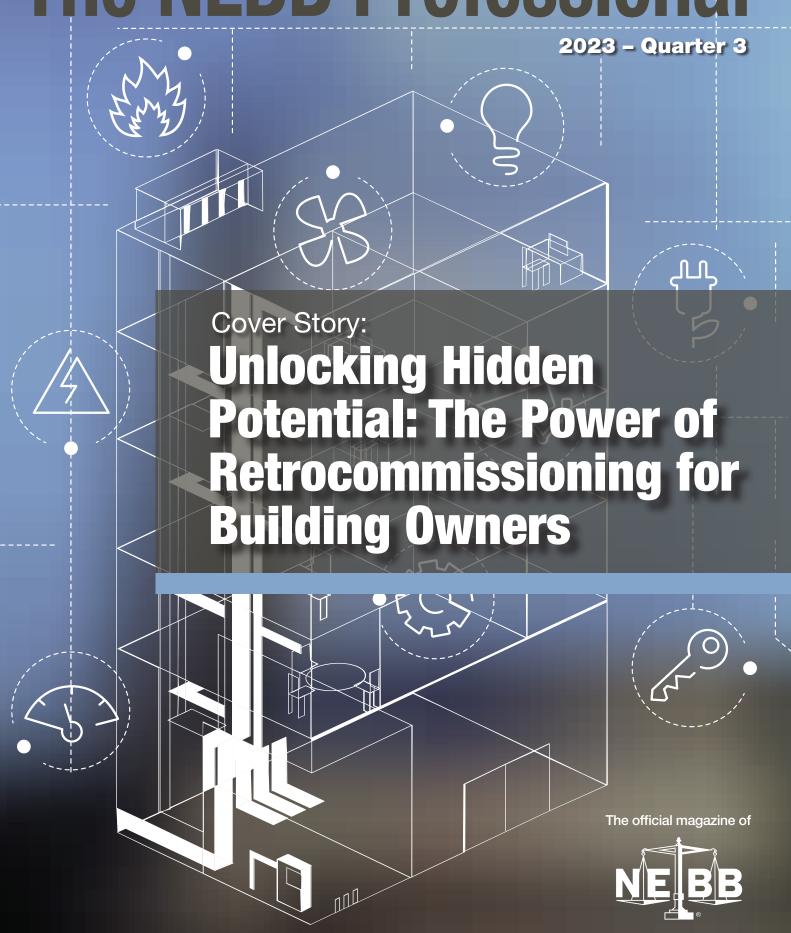
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President's Message





This spring, I had the honor of hosting the Gawne family for our grand opening of the Robert B. Gawne Training Center at NEBB's headquarters in Gaithersburg, MD. The staff did an incredible job of getting the center ready, along with decorations, food, and drinks. The weather was outstanding, and it was simply an incredi-

ble day to showcase the new venue. Every one of our disciplines now has the capacity to provide hands-on training, and for a select few committees the ability to host practical exams. So many vendors donated equipment and many contractors donated their labor and materials. We cannot thank them enough.

Please see the articles surrounding our new training facility starting on page 29.

Our mid-year meeting was held at the Skamania Resort in Stevenson, WA. The hotel sits on the east edge of the Columbia River Gorge, where its waters cut through the Cascades Range. With the snow line just above the resort, when the clouds broke for a few minutes, the views were spectacular. The committee meetings went well, and goals were set for the rest of the year. I cannot thank the volunteers enough that put so much time and effort into their respective disciplines. Thank you one and all.

When time has allowed me, I've been able to visit a few chapter recertification meetings, with a few more on the horizon. I wish I could have been to each and every one, but the energy of those that I've attended has been is incredible. Florida EBB and Bonneville EBB were so much fun. Coming up, I'll be attending the Pacific Southwest and Mid-South meetings prior to the Annual Conference in Monterey, CA.

I'm a strong believer in the work of our chapters and all are contributing so much to NEBB. NEBB is only as strong as our chapters. Our chapters are only as strong as our firms, and our firms are only as strong as the individuals in the field.

To all of you, thank you! I am excited to be handing over this office to my friend, Luis Chinchilla at the conference in October. NEBB will be in the best of hands.

Phil Emory

NEBB President



Mensaje del presidente

Como es el caso para todos los presidentes de NEBB, el año se pasa volando y el final llega rápidamente. Este año ha sido un año emocionante en mi carrera y espero sea considerado un año exitoso para NEBB.

Esta primavera, tuve el honor de recibir a la familia Gawne para la gran inauguración de nuestro centro de entrenamiento The Robert B. Gawne NEBB Training and Education Center en las oficinas centrales de NEBB en Gaithersburg, MD. Los empleados hicieron un trabajo increíble para tener el centro de entrenamiento listo, incluyendo las decoraciones, alimentos y bebidas. El clima fue excelente y simplemente fue un día increíble para demostrar las nuevas instalaciones. Cada una de nuestras disciplinas tiene ahora la capacidad de proveer entrenamiento práctico y se cuenta con la posibilidad de llevar a cabo exámenes prácticos para un grupo selecto de comités. Muchos proveedores donaron equipo y muchos contratistas donaron mano de obra y materiales. iNo podemos agradecerles lo suficiente!

Por favor lea los artículos acerca de nuestro nuevo centro de entrenamiento que empiezan en la página 29.

Nuestra reunión de medio año fue realizada en el Hotel Skamania en Stevenson, WA. El hotel se ubica sobre el margen oriental del desfiladero del Río Columbia, donde sus aguas fluyen a través de la cadena montañosa de las Cascadas. Con la línea de nieve justo arriba del hotel, cuando las nubes se abrieron por algunos minutos, las vistas fueron espectaculares. Las reuniones de los diferentes comités fueron muy buenas, y se establecieron las metas para el resto del año. No puedo agradecerle lo suficiente a los voluntarios que brindaron tanto tiempo y esfuerzo en sus respectivas disciplinas. iGracias a todos y cada uno de ustedes!

Cuando el tiempo me lo ha permitido, he tenido la oportunidad de visitar algunas reuniones de recertificación de diversos capítulos, con algunas más en el horizonte. Hubiera deseado poder estar en todas y cada una de ellas, pero la energía de aquellas a las que he podido asistir ha sido increíble. Florida EBB y Bonneville EBB fueron muy divertidas. Próximamente, asistiré a las reuniones de Pacific Southwest y Mid-South previas a la conferencia anual en Monterey, CA.

Soy un firme creyente en el trabajo de nuestros capítulos y todos están contribuyendo grandemente a NEBB. NEBB es únicamente tan fuerte como lo son nuestros capítulos. Nuestros capítulos son tan fuertes como los son nuestras empresas, y nuestras empresas son tan fuertes como lo son los individuos en el campo de trabajo.

iA todos ustedes, muchas gracias! Estoy emocionado de hacer entrega de esta oficina a mi amigo, Luis Chinchilla en la conferencia en octubre. NEBB va a estar en las mejores manos.

Phil Emory

Presidente de NEBB



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JON SHEPPARD YPN

Letter from the Editor



It's been about a year now that I have served as editor of this magazine. With industry professionals in mind, we have strived to increase the value provided to readers through informational articles, lessons learned through NEBB Professionals' work in the field, and hot topics and innovations that have been prevalent throughout the industry recently.

I am grateful to the many professionals that have dedicated their time and expertise to *The NEBB Professional* this past year, and hope to see many new names in our contributors section in the months to come.

As we continue this momentum through the end of 2023 and beyond, I'm excited to share this very special issue with you! In addition to our regularly scheduled features and columns, we have curated a section of content focused on the Robert B. Gawne NEBB Training and Education Center, as well as a preview of the 2023 NEBB Annual Conference in Monterey, CA. My hope is to give our readers a glimpse of the unique opportunities NEBB offers the industry.

As always, I would love to hear your feedback on this issue as well as your ideas for the future! Please contact me at editor@nebb.org to get the conversation started.

Kerri Souilliard, Editor



CONTRIBUTORS



of NEBB and serves as Director of Commissioning for Newcomb & Boyd a 100 year Consulting Engineering firm in Atlanta Georgia. Steve has served on numerous NEBB and industry committees and ANSI Standard development initiatives.



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certifications in Cx and BET. Mr. Hinton currently serves on the Board of Directors for NEBB.



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▶ Dane Gresko is a certified NEBB TAB, with nearly 17 years of experience in HVAC and the Sheet Metal Industry. He is a Project Manager for Fisher Balancing Co., Williamstown, New Jersey where he has worked for the past 13 years.



Tiffany Meyers is the executive vice president of NEBB and works with the Board of Directors to oversee NEBB at a national level. She has previously served as director of operations for NEBB and chapter coordinator for Capital MarVa International NEBB.

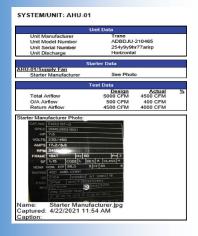


Jeff Schools is the Past President of NEBB and currently works with the NEBB Headquarters team, NEBB committee chairs, and Compliance members as NEBB Technical Director.





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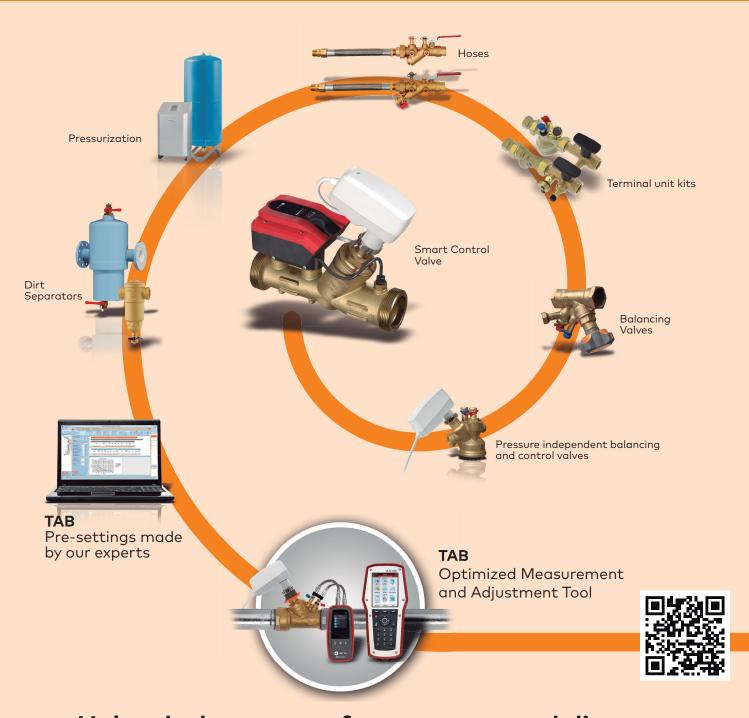
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Executive Vice President's Message

Concept and initiation. Planning, execution. Monitoring and project close. These are the five major fundamentals of project management. Towards the end of 2017, a vision for NEBB to be able to offer a high level training formed, and a concept was born. The vision was to build an education and training center so that NEBB could not only offer and deliver classroom training, but also hands-on opportunities. Planning, execution, and monitoring continued into 2018 with the first part of the training center, the educational classroom. NEBB started hosting seminars in Gaithersburg, MD, allow-



ing for a more personalized experience. From 2018 through 2020, more planning for the hands-on side continued. Then Covid hit, which as we all know, affected everyone, including our movement with this project. When Jeff Schools joined NEBB in November of 2021 as the Technical Director, he took this project over and movement started to happen again, despite material delays and circumstances that were beyond our control. During this time, we were able to take advantage of available space in our building, so we jumped at the opportunity to be able to expand, allowing for additional space and opportunities for our disciplines. Good things DO come to those who wait!

The focus and goal moving into 2023 was to complete the Robert B. Gawne NEBB Training and Education Center, bringing us to the last fundamental, project close. Through countless hours of hard work, dedication, and the generosity of several donors, on May 11, 2023, the Robert B. Gawne NEBB Training and Education Center had its Grand Opening and Ribbon Cutting Ceremony which was an amazing success! Please allow me a little grace to thank those who played a huge part in making this day possible. Since joining NEBB, Jeff Schools has dedicated many hours to this project and under his guidance, we will now be able to offer state-of-the-art hands-on training for our candidates. Christina Spence, NEBB's Executive Coordinator, did a truly amazing job managing and executing all the moving parts associated with planning the event. NEBB leadership, both current and past, played a key role in the success of the project with their patience and constant support. In addition to the





Board that is serving now, Don Hill, Jim Whorton, Jeff Schools and Amber Kelly fully supported this project during their presidency years. Unity is strength...when there is teamwork and collaboration, amazing things can be achieved. I'd also like to extend a big thank you to all the contributors and those involved for their generosity and support.

During my time with the Capital-MarVa chapter, I had the extreme privilege of meeting Mr. Robert Gawne. Mr. Gawne was one of the founding members of NEBB and his hard work and dedication formed the backbone of our association. He was a great supporter of NEBB's mission and when the opportunity presented itself, he not only jumped at the opportunity to support building the training center, but also initiated a generous donation by Stromberg Sheet Metal and Comfort Control to supply all the sheet metal in the training center, along with the many hours of labor required to install it. His wife, Patricia, daughters, Kathy and Tish, as well as several other family members attended the Grand Opening and Ribbon Cutting Ceremony. It was an emotional moment for all and quite the honor and privilege to be able to name the training center after a man who not only served as the 17th President of NEBB, but was also instrumental in creating this organization that has been going strong for 50-plus years.

"Vision without action is a dream. Action without vision is simply passing the time. Action with vision is making a positive difference" – Joel Barker.



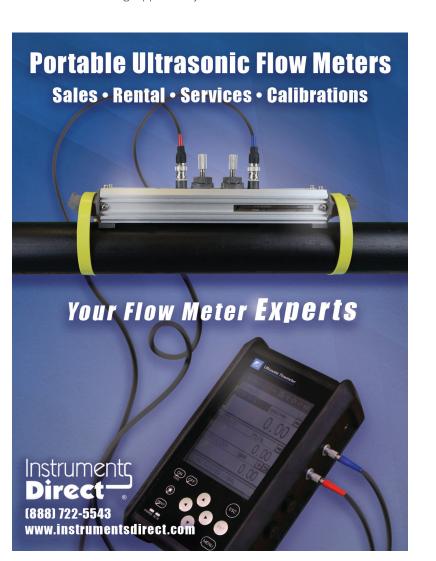




Continuous learning and professional development are vital for staying ahead in the industry. Discover the latest training opportunities to ensure you deliver topnotch services to your clients by attending one of our seminars at the new Robert B. Gawne NEBB Training and Education Center!

Since my last message, staff has continued to oversee and successfully manage recertification, as well as new firms and candidacy applicants. Based on the numbers I continue to see, there is no slowing down. The TAB Seminar in February and May were full, the Cleanroom Seminar in March had a waiting list and the Fume Hood Seminar in June had one of the highest numbers of attendees since giving the seminar at Labconco-and the FHT exam schedule was full. Due to the high demand for the CPT CP exam, we are now offering this exam on a quarterly basis at NEBB Headquarters.

The Technical Committee Mid-Year meeting was held in Skamania, WA in March, and proved to be an amazing opportunity for collaboration between the NEBB





"Vision without action is a dream. Action without vision is simply passing the time. Action with vision is making a positive difference" – Joel Barker.

committees. New ideas for online content, exam development, industry updates and cross-committee projects were the focus with an end goal to be able to provide more for our current and incoming certificants.

As we move forward into the second half of 2023, staff and leadership will continue to be busy preparing for the Annual Conference, **NEBB 2023: Challenging the Next Generation**, in Monterey, CA.

This annual networking and educational program is geared towards NEBB industry professionals and technicians, giving them the chance to network with familiar friends, make new industry connections and expand their professional horizons. Please plan to join us for the opportunity to explore the latest trends and obtain technical updates, while getting your continuing education credits in a beautiful location!

Tiffany Meyers

NEBB Executive Vice President

Unlocking Hidden Potential: The Power of Retrocommissioning for Building Owners

By Steve Wiggins

What is Retrocommissioning (RCx) and why should owners invest in it? Performed correctly, there is no process in the marketplace that can have a greater impact on our carbon footprint than RCx-and more importantly, have a greater impact on the proper operation of our facilities.

As a process, RCx has been around for many decades. I worked for Headquarters Air Force Civil Engineering Support Agency (HQ AFCESA) in the late 1980s and, as an owner organization, they had been retrocommissioning existing facilities and acceptance testing their new facilities for a number of decades. The leaders of that organization were truly ahead of their time, as they also combined training the local operation staff with their RCx efforts. They recognized the importance of educating the local hands-on staff on how to maintain the optimized systems that were retrocommissioned to ensure persistence in their proper operation.

So why did this owner perform RCx? The number one driver was not energy reduction, but to improve facilities operations and resiliency. Many of the facilities that we were called to work on were in a failed state and the expectation was that implementation of the RCx process would result in a facility that worked to its best possible state without capital improvement. Their Civil Engineering Maintenance Inspection and Repair Teams (CEMIRT) originally utilized emergency response teams for any critical facility in the world. These

teams responded and repaired facilities to get them operational as quickly as possible. When they noticed that a number of these facilities were repeat "failures," the teams then combined training the local operations staff with the RCx to produce persistence in the facility systems.

As an added benefit, their efforts greatly reduced the energy consumption in these facilities, too. The driving force, however, is proper performance and occupant satisfaction.

Traditionally, there have been two driving forces in owners choosing to perform RCx on existing facilities: energy reduction and lack of proper performance. I have been involved in performing RCx in hundreds of facilities in my career, and most of those projects have produced a significant reduction in energy consumption. Only two facilities found a need to consume more energy for proper operation. Both of those facilities had their outside air intakes completely blocked and a number of pieces of equipment inoperable at the

..... The NEBB Professional | Quarter 3 | 2023 beginning of the projects. But all of the RCx projects we have performed have been primarily driven by the need for proper performance.

We performed RCx on 118 facilities for a client located across the country in all of the major climate zones in the continental United States. The performance in these facilities improved to the point that the client reported receiving letters of appreciation from the occupants of all 118 facilities. The client also monitored the energy consumption in these facilities and saw a reduction in electrical consumption of 18 percent and a reduction of natural gas by 40 percent. These projects easily paid for themselves in less than 18 months.

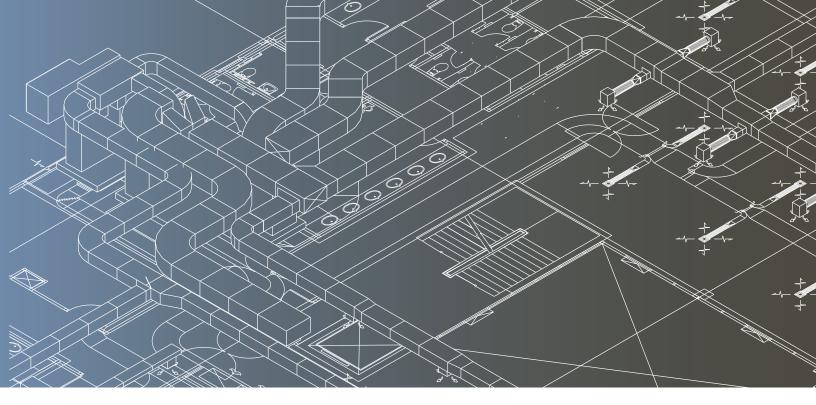
The process that we utilize when we perform RCx is delineated in ANSI/NEBB Standard 120-2019, Third Edition, Technical Retro-Commissioning.

The US Energy Information Administration states, "In 2021, the combined *end-use energy consumption* by the residential and commercial sectors was about 21 quadrillion British thermal units (BTUs).\(^1\) This was equal to about 28 percent of total U.S. end-use energy consumption in 2021. End-use energy consumption includes primary energy consumption and retail electricity sales, but excludes electrical system energy losses.

Total energy consumption by the residential and commercial sectors includes end-use consumption and electrical system energy losses associated with retail electricity sales to the sectors. When electrical system energy losses are included, the residential and commercial sectors accounted for about 21 percent 18 percent, respectively—39 percent combined—of total U.S. energy consumption in 2021".²

Taking that into consideration, why should owners perform RCx on their facilities? First, to provide facilities that meet their Current Facilities Requirements (CFR). The majority of existing buildings do not meet their original Owner's Project Requirements (OPR) aspects and they surely do not meet their CFR requirements!

¹ Monthly Energy Review, Tables 2.2 and 2.3, December 2022. 2 Monthly Energy Review, Table 2.1, December 2022



In my experience, very few owners have an original OPR and even fewer have developed a CFR for their facilities. We typically develop a CFR as part of the RCx process. Meetings are scheduled with key stakeholders in the facility to determine what they need the facility to provide so they can efficiently and effectively perform their tasks to achieve the company's goals. A series of questions is presented to determine if there are any existing issues with facilities systems included in the scope for the project. These questions also include inquiries related to the RCx project timeline, hours of operations, manpower in all spaces and other pertinent elements of the process.

Once the CFR is developed, the RCx plan and datalogging plan are created by the RCx team. It is highly recommended that the maintenance team for the facility participate as a part of the RCx team. There is no better training available than the RCx process to provide the facilities operations team with the knowledge needed to keep a facility operating at peak levels.

Performing RCx as presented in ANSI/NEBB Standard 120-2019, Technical Retro-Commissioning of Existing Buildings requires trained staff with the ability to perform numerous in-depth tasks throughout the entire process. Standard 120 presents the RCx process as if it is linear in nature due to the constraints that are part of the ANSI standard process. However, the process is actually circular, repeating itself at many different

points during assessment and discovery. As issues that are contributing to the less-than-optimal performance of systems are uncovered and corrected, the discovery portion of the process is executed repeatedly, as needed. Any issues that can be corrected utilizing a "quick fix" approach are corrected by the RCx team on the spot. This results in a better operating facility early on during the process. Each system and sequence are evaluated for optimal operation, and new optimized sequences are programmed and downloaded to increase system performance.

As the process continues, each of the systems are investigated and optimized as needed, any issue requiring either capital investment, remedial design, and/or additional resources to correct discovered issues are dealt with by the owner and the RCx team.

The following are examples of issues that have been discovered and corrected during actual RCx projects:

RCx Example 1

The variable air volume (VAV) controllers for the terminal units in the facility were not set up and operating properly. Judging by the percentage of devices that were found not set up correctly, it would appear that they had never been set up. All of these devices were calibrated and set up by the team, taking approximately six weeks of the team's time. The specific details for

each controller are included in Appendix A, Diffuser and Grille Test Data Forms.

The air-handling units (AHUs) were tested after the terminal unit testing was complete. The inlet vanes for the variable air volume AHUs were found to be in very poor condition. The leakage of the vanes in the fully closed position was so great that the static pressure in ductwork was over 4" on a couple of units. All of the inlet vanes were replaced with variable speed drives. The control programs for the AHUs in the facility were found to be incorrect in every unit. The team wrote, installed, and debugged new control programming for every AHU in the facility.

The laboratory areas of the facility were tested for proper pressurization. All of the laboratories were found to be operating out of proper parameters. The supply and exhaust terminal were balanced to provide proper pressures in all rooms that had pressure regime requirements. The corridors on the third and fourth floor were not designed to have make-up air terminal units. The corridors are the reference point for the laboratories; a constant pressure in the corridors is critical for efficient pressure control. The team recommended that make-up terminal units be added in the corridors on both the third and fourth floors and a cost estimate was provided.

The central energy plant was being operated manually when the team arrived on site. There were several factors contributing to the need for manual operation of the chillers and boilers. These included no programmed sequence of operation, incorrect piping of the chilled water loop including two decoupler lines with neither one installed in the correct location, and less than optimum piping of the hot water boilers and the steam heat exchanger. The waterside economizer for the chilled water loop was also disabled. Since the owner had a full-time piping shop, the team re-piped the central energy plant chilled water and hot water loops and wrote programs for both systems. These programs were installed and debugged.

These efforts not only resulted in a properly functioning facility, but also reduced the energy consumption by \$72,000 per year.

RCx Example 2

On another project, the owner had installed pressure independent energy valves as a means of trying to correct perceived issues with their two central energy plants. They reported that they had contracted with the manufacturer to set up the valves on four different occasions with poor results all four times. The RCx team checked the setup and found no consistency in the setup of the valves. Through discussions with the owner operations staff, the best setup for their application was determined. After setup, the delta T at the plants was found to increase from 4-5°F to 13-14°F, resulting in better performance of the plants.

During the discovery of the laboratory systems, the AHU was found to be providing 16,131 CFM while it was designed to supply 23,682 CFM or 68 percent of design. One branch duct serving room 107 was analyzed to determine the cause of the low airflow. Inlet static pressure was found to be 2.2"w.c. at the inlet of the terminal unit and at the inlet of the reheat coil downstream from the supply balancing valve. Static pressure on the discharge side of the coil was found to be .145"w.c., an extremely high static pressure drop indicating that the coil was blocked with dirt and trash. The access door for the coil was removed and Figure 1, Coil Face shows the condition of the coil.

The exhaust fan (EF) that serves the same area as the AHU flow volumes were tested. All three of the fume hoods served by this exhaust fan were found to be



within acceptable values. However, the overall exhaust volume for the fan for this floor was extremely low. The total flow volume needed for this system was 22,234 CFM, while the actual flow for this fan on this floor was found to be 11,630 CFM or 52 percent. We tested the branch duct serving one of the student work benches. The static pressure before the balancing valve was found to be -5.25"w.c. and the static pressure after the cross-flow in the terminal unit was found to be -.24"w.c., making for a total drop across the terminal unit of -5.01"w.c. This drop normally should have been around -.6"w.c. A hole was drilled in the duct before the cross-flow and a fiber-optic probe was inserted to inspect the terminal unit, allowing us to discover that the cross-flow was completely blocked with paper.

Another AHU was tested next. It was designed to supply 29,008 CFM, but testing revealed an actual supply volume of 21,417 CFM or 74 percent of design. One of the branch ducts serving a portion of the area was analyzed to determine the cause of the low airflow. Inlet static pressure was found to be 4.97"w.c. at the inlet of the terminal unit and 4.81"w.c. at the inlet of the reheat coil downstream from the supply balancing valve. Static pressure on the discharge side of the coil was found to be .023"w.c., an extremely high static pressure drop indicating that the coil was blocked with dirt and trash. The access door for the coil was removed and Figure 2, Coil Face shows the condition of the coil.

The EF serving the same area as the AHU was tested. All of the fume hoods served by this EF were found to be within acceptable values. However, the overall exhaust volume for the fan for this floor was extremely low. The total flow volume needed for this fan was 28.145 CFM, while the actual flow for this fan was found to be 16,177 CFM or 57 percent. We tested the branch duct serving one of the student work benches. The static pressure before the balancing valve was found to be -4.397"w.c., and the static pressure after the cross-flow in the terminal unit was found to be -.1125"w.c. for a total drop across the terminal unit of -4.285"w.c. This drop normally should be around -.6"w.c. A hole was drilled in the duct before the crossflow and a fiber-optic probe was inserted to inspect the terminal unit. We discovered that the cross-flow was completely blocked with paper.



The RCx project was temporarily halted while the owner marshalled a quick fix team to clean all of the reheat coils, clean all crossflows, and install wire mesh at the workbench opens to prohibit papers from being sucked into the system.

After this effort was executed, the RCx process continued and the systems were optimized. Additional issues were discovered and corrected during the process, allowing the facility to perform at a high level upon completion of the project.

RCx Example 3

One more example I can give of an RCx project is a five-story building that had four AHUs serving the facility in vertical stacks. This meant that the RCx team had to treat the mechanical system as if it were one system with five supply fans and cooling coils.

The system airflows were tested for correct volumes. These tests were performed at the VAV terminal units first, and then each air handling unit was tested. Each terminal unit and associated room temperature sensor was checked for proper calibration and operation.

Upon arrival at this facility, the commissioning team carried out a test on the building pressure and found the facility to be in an extreme negative pressure condition. The facility had four constant volume relief fans (RF-1, RF-2, RF-3 and RF-4) installed on the fifth floor



for the purpose of maintaining proper building pressurization, approximately +.05"w.c. These fans were designed to relieve 17,075 CFM of air. The team proceeded to experiment with the relief fans and ended up with all relief fans turned off and the facility still measuring -.026"w.c. The team investigated further to determine the cause of this negative pressure condition. Such a condition in a facility can very easily lead to health and environmental impacts, such as high humidity and eventually mold growth.

The design airflows for each AHU are shown in Table-1: AHU Air Volumes. As the airflow for each AHU varies between the minimum and maximum air volume, the outside air volume must remain constant. The units designed to control the outside air volume to accom-

plish this task, however, were non-existent. Further assessment of the four AHUs revealed that the outside air ductwork in the units had failed due to high velocity and oil-canning.

Recommendations from the commissioning team to increase the dimension of the outside air intake duct to reduce the airflow velocity and to install static pressure transducers in the mixing chambers of the AHUs were discussed. The owner carried out the replacement of the outside air ductwork on all four units and installed the static pressure transducers. When the outside air ductwork project was completed, the team set the outside air to the required values on all four AHUs. Pressure tests revealed that once the systems were set up, the facility maintained its proper relationship to the outside.

The decisions regarding budget and what to correct when executing a RCx project must be a collaborative effort between the RCx team and the owner's staff. RCx varies from new building Cx in that any owner will tell you that their expectation for their new building is to achieve as close to 100 percent perfect as possible. I like to call the desire on a RCx project a sliding scale of economics. In other words, we want to get an existing building as close to 100 percent perfection of the CFR as the owner's budget will allow. It has been our experience that if you can take a building from below 60 percent performance to a percent in the high 80s for the cost of RCx, the vast majority of owners will be satisfied with that. Some facilities and CFR will require capital investment due to the nature of issues found within the systems. In those cases, the RCx team works with the owners team to determine what must be done at a minimum to satisfy safe and proper operation for a facility.

Table 1. AHU Air Volumes								
AHU	Design CFM Max	Design CFM Min	New CFM Min					
AHU-1	28,865	13,535	7,525					
AHU-2	34,905	17,740	10,400					
AHU-3	22,260	17,485	14,470					
AHU-4	37,530	21,330	14,060					

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Testing and Balancing to Achieve Comfort

By Tarek Omar

The NEBB TAB Procedural Standard states that there are two main conditions which need to be fulfilled to consider any HVAC system correctly balanced:

- 1. All measured air flow/ hydronic flow quantities are within ±10% of the design flow quantities unless there are reasons beyond the control of the CF.
- 2. There is at least one path with fully open air damper/balancing valves from the air moving equipment/pump to a terminal device.

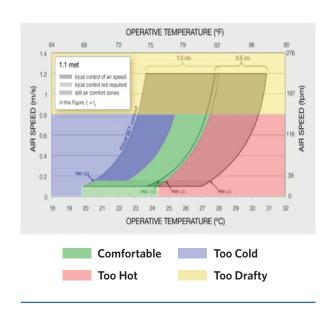
However, are those two conditions enough to achieve the main purpose of the HVAC system? The answer simply is NO. Those two conditions are only a way to standardize the procedures of testing and balancing work and make it easily and systematically processed by anyone.

To better answer the question, we need to go back to the fundamentals of HVAC science and ask ourselves about the main purpose of HVAC systems. HVAC systems are a way to control the climate inside a certain space to achieve occupant comfort regardless of what the outside climate conditions are.

This then raises a new question: what does comfort mean? And what are its parameters?

The term "comfort" takes you, at first glance, to the thermal comfort zone basics mentioned in ASHRAE Standard 55. Humans generally feel comfortable between temperatures of 22°C to 27°C and a relative humidity of 40 to 60 percent, but this is not the complete story!

Along the history of ASHRAE Standard 55, the definition of comfort and its parameters have continually de-



veloped. The newest update, 2017 ASHRAE Standard 55, includes a new element that can take into consideration the change in occupants' thermal comfort from direct solar radiation, in addition to the existing scope, requirements, conditions, and parameters. The four pillars of the ASHRAE Standard 55-2017 are:

- The six environmental and personal factors taken into account are temperature, thermal radiation, humidity, airspeed, activity level (metabolic rate), and occupant clothing (degree of insulation).
- 2. In order to comply with ASHRAE 55, all of these factors must be accounted for in combination.
- 3. The thermal conditions that ASHRAE aims to achieve are applicable to healthy adult occupants, up to an altitude of 3,000 meters, where occupancy time must surpass 15 minutes.

Definitions of the parameters involved in the four pillars of the ASHRAE Standard 55-2017:

Airspeed:

The rate of air movement at a given point in time regardless of the direction.

Clothing:

Used to represent the thermal insulation from clothing, where 1 clo = winter clothing and 0.5 clo = summer clothing.

Metabolic Rate (M):

The rate of transformation of chemical energy into heat and mechanical work by metabolic activities within an organism is usually expressed in terms of the unit area of the total body surface. In this standard, the metabolic rate is expressed in met units.

Relative Humidity (RH):

The ratio of the partial pressure (or density) of the water vapor in the air to the saturation pressure (or density) of water vapor at the same temperature and the same total pressure.

Mean Radiant Temperature (tr):

The uniform surface temperature of an enclosure where an occupant would exchange the same amount of heat as in the actual non-uniform space, calculated from the weighted temperature average of each surface divided by the total area of the space.

Acoustics Comfort:

Acoustic comfort is the environmental and psychological situation of an individual in an environment in terms of noise levels and other parameters that may be detrimental to concentration, communication, rest or health. Refer to Design guidelines for HVAC-related background sound in rooms (ASHRAE, 2011).

Air Quality and Air Change:

Indoor air quality (IAQ) is compromised by pollutants such as dust, pollen, mold, mildew and volatile organic compounds. Refer to ANSI/ASHRAE Standard 62-2001 - Ventilation for Acceptable Indoor Air Quality.

ACPH = 60 Q / Vol

Where:

ACPH: Air Change Per Hour

Q: Volume flow rate Vol: space volume

NC/RC	Room Type		Octave band analysis	Approximate overall sound pressure level		
Hotels/Motels Service/support areas			NC/RC	dBA	dBC	
Executive and private offices 30 35 60	Hotale/Matale	Corridors and lobbies	40	45	65	
Conference rooms 30 35 60	rioteis/ivioteis	Service/support areas	40	45	65	
Office buildings Teleconference rooms 25 30 55 Open-plan offices 40 45 65 Corridors and lobbies 40 45 65 Courtrooms Unamplified speech 30 35 60 Amplified speech 35 40 60 Performing spaces Music teaching schools 25 30 55 Music practice rooms 30 35 60 Hospitals and clinics Wards 35 40 60 Operating and procedure rooms 35 40 60 Corridors and lobbies 40 45 65 Laboratories Testing/research with minimal speech communication 50 55 75 Laboratories Extensive phone use and speech communication 45 50 70 Group teaching 35 40 60 Churches, mosques, synagogues General assembly with critical music programs 25 30 55 Schools Large lecture rooms with speech amplification		Executive and private offices	30	35	60	
Open-plan offices		Conference rooms	30	35	60	
Courtrooms	Office buildings	Teleconference rooms	25	30	55	
Courtrooms		Open-plan offices	40	45	65	
Courtrooms		Corridors and lobbies	40	45	65	
Amplified speech 35 40 60	Countroomo	Unamplified speech	30	35	60	
Performing spaces	Courtrooms	Amplified speech	35	40	60	
Music practice rooms 30 35 60		Drama theaters, concert and recital halls	20	25	50	
Patient rooms 30 35 60	Performing spaces	Music teaching schools	25	30	55	
Hospitals and clinics Wards 35 40 60		Music practice rooms	30	35	60	
Clinics		Patient rooms	30	35	60	
Corridors and lobbies 40 45 65	Hospitals and	Wards	35	40	60	
Testing/research with minimal speech communication 50 55 75	clinics	Operating and procedure rooms	35	40	60	
Laboratories Extensive phone use and speech communication 45 50 70 Group teaching 35 40 60 Churches, mosques, synagogues General assembly with critical music programs 25 30 55 Classrooms 30 35 60 Schools Large lecture rooms with speech amplification 30 35 60 Large lecture rooms without speech amplification 25 30 55		Corridors and lobbies	40	45	65	
Group teaching 35 40 60		Testing/research with minimal speech communication	50	55	75	
Churches, mosques, synagogues Classrooms Classrooms Classrooms Clarge lecture rooms with speech amplification Large lecture rooms without speech amplification 25 30 55 60 Large lecture rooms without speech amplification 25 30 55	Laboratories	Extensive phone use and speech communication	45	50	70	
Synagogues General assembly with critical music programs 25 30 55		Group teaching	35	40	60	
Schools Large lecture rooms with speech amplification 30 35 60 Large lecture rooms without speech amplification 25 30 55		General assembly with critical music programs	25	30	55	
Large lecture rooms without speech amplification 25 30 55		Classrooms	30	35	60	
33	Schools	Large lecture rooms with speech amplification	30	35	60	
Libraries 30 35 60		Large lecture rooms without speech amplification	25	30	55	
	Libraries		30	35	60	

Location Type	Suggested Outdoor Air Ventilation Rate (air changes per hour)
Homes	0.35–1
Hotel Rooms	1–2
Offices	2–3
Retail Shops	2–3
Schools (except lecture halls)	5–6
Sports Facilities	4–8
Restaurants	6–8

4. This standard does not take into consideration factors such as air quality, acoustics, illumination, or contamination.

As an engineering rule of thumb, a higher level of perfection tends to mean higher costs and a less economic system. That's exactly why testing, adjusting, and balancing (TAB) was founded. TAB is the tool which links the theoretical and the practical parts together.

When we apply TAB procedures, we are trying to close the gap between design requirements (the theoretical part) and the system implemented in real life with all its manufactured tolerances and human errors (practical part) as much as possible.

Designers can create a self-balanced duct, but to do that they need to size it right. Let's imagine, for example, the duct size needs to be 22 and a quarter inches. Yes, it is possible to manufacture 22 and a quarter inch duct, but it will be so costly and not economic, not to mention the tolerance of the machine used to manufacture the duct, too. The quarter inch which makes the duct balanced can be substituted by duct mounted volume dampers to compensate for the pressure loss. The same is applied on hot/chilled water systems.

For a certain period, that was enough, but now-a-days it is not. As comfort parameters become more sophisticated, systems also become more and more advanced to try to fulfill such parameters. In the past, it was assumed that by achieving correct air and water flow rates, all comfort parameters would be fulfilled automatically. At that time, those assumptions were correct because parameters were few and easy to achieve.

Such sophisticated systems need more professional hands to deal with them-hands which are not only specialized and trained, but also have the skills to find solutions for any obstacle which may be found in real life. With this, standardizing the profession becomes mandatory by developing standards and procedures to be followed by professionals. NEBB has been a pioneer in this since its establishment in 1971.

One of the most well known obstacles facing TAB engineers and technicians is the diversity of comfort for every human being. That's why, in some cases, we need some minor adjustments to achieve the above comfort conditions. Those minor adjustments need to be coordinated mainly with the owner, consultant, commissioning firm and operator.

The coordination process itself needs to be done through a commissioning firm and executed by a testing and balancing firm. Documentation of such minor adjustments is mandatory to preserve the history of the project and use it as a benchmark in the future.

Usually, such minor adjustments are applied on the air side by increasing/decreasing flow rates from design values by more or less than the allowable tolerance to achieve airspeed, air change, noise level, temperature and relative humidity. Do not forget, nothing is perfect in real life.

In some cases, a major change needs to take place to achieve comfort conditions. Such cases are typically due to either a fatal mistake in design or changing the usage of the space. The testing and balancing firm is NOT involved in this case.

In conclusion, many sciences and discoveries throughout history were, and still are, aimed at human comfort throughout all fields. The science of air conditioning and adapting the weather is no different. Humans have been constantly developing the concept of comfort to comply with emerging science and technology that enables control of the surrounding environment.

Testing, adjusting and balancing, as a part of air conditioning science, has also evolved from just a tool to adjust the performance of central air-conditioning systems to an essential process which is now indispensable. That's because TAB has become the link between the theoretical and the practical. Applying TAB procedures correctly frames the effort of all parties on a project, as well as serves as the final result that is seen and felt by occupants. •



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AN INTRODUCTION TO AHU CASE LEAKAGE TESTING

By John Mazza

For the last 10 years, there has been a steady march towards energy efficiency reflected in New York City (NYC) building mechanical codes, which is my firm's primary area of service. Presently, throughout the United States and not just major metropolitan jurisdictions, most HVAC industry stakeholders are striving to reduce energy consumption while maintaining performance and occupant comfort in every opportunity available.

Some of those energy efficiency opportunities are innovations in technology such as ECM drives, variable refrigerant systems eliminating the need for multiple condensing units and large duct runs, and pressure independent control valves reducing hydronic overflow conditions throughout the building.

When innovating is not the answer to increasing efficiency, reducing wasted energy is the next target. NEBB certified TAB firms may be familiar with their portion in this reduction of wasted energy by taking part in Air Duct Leakage Testing scopes for their projects, either witnessing or executing the test. Typically, the project will test a duct riser or medium pressure duct from the inlet of a terminal device such as a VAV to the inlet of the air handler. Eliminating leakage at the air handling unit by specifying <u>AHU Case Leakage</u> Testing is one step in that effort.

Since air handlers are manufactured, TAB firms have traditionally had very little to do with Case Leakage



Tests. The factory establishes a performance sheet based on AHRI criteria in a testing lab. NEBB Procedural Standards only prescribe performance testing of the units, never developing testing methods for AHU Case Leakage. The manufacturer tests the units following AHRI Standards 1350 (I-P) and 1351(SI) Mechanical Performance Rating of Central Station Air-handling Unit Casings and/or AMCA Standard 210-2007 for their testing methodology and resulting data is used to rate the performance listed in the manufacturer equipment submittal.

However, for larger air handling equipment that logistically can only be built up onsite by the contractor who deals with many large sections (sometimes stacked one on top of another), a factory test can no longer ensure case integrity in the field. Mechanical engineers have recognized the need to confirm the integrity of these cases because of their concern about leakage at the section connections, seals, doors, panels, electrical penetrations, flanges, and other openings that have been affected by field construction activities. I think most TAB professionals can testify to witnessing what happens when a unit is porous with a high suction or discharge static. On occasion, my firm has witnessed enough case leakage that by doing the integrity test and resealing, a regain of up to 5 percent total design CFM airflow is possible. This is impactful with units that move CFM by the tens of thousands.

In this article information is provided detailing where case leakage testing shows up in the job specification, how to prepare case leakage testing procedures, and some best practices for executing your method of procedure. Understand that the standards for case leakage testing are guideposts and the manufacturer may provide a manual for field case leakage testing that would be relied upon to run the test.

Case deflection is often specified as part of the Case Leakage Test. This is a test that measures the deflection of a pressurized cabinet section at a fixed point midway on the exterior panel. Deflection measurements are taken during the positive pressurization test. Deflection measurements will not be discussed further in this article.



AMCA 210-6 Test Chamber <u>Stefano Castelnuovo. 2002</u>7 Rescaldina, Metropolitan City of Milan, Italy

It is important to define the AHU case or cabinet. The case or cabinet is the enclosure which houses the fans, coils, filters, and other components of the AHU and is generally made of metal and lined, as necessary, with material for thermal insulation and/or acoustic attenuation. It contains the air that is being conditioned, is exposed to the fan pressure, and separates the conditioned air from the surrounding air. This does not include the inlet or outlet connected to ductwork or accessories such as an outside air economizer hood connection for a typical multi-section field erected rooftop unit.

In 2022 my firm, Airpath Testing Services, was solicited to perform Field Case Leakage Testing on more than 50 built up air handling units at 270 Park Ave, the new JP Morgan Chase Headquarters. Each floor was designed with two or more built up air handling units. The initial request for this scope came from the "Rider A" pages of the bid solicitation for the prime mechanical contractor. Airpath was only engaged after we had contracted TAB services. That is often the case, since this request does not originate in the TAB specification. Refer to the following excerpt for the language that would initiate a unit case leakage testing scope:

"AHU PRESSURIZATION SCOPE: RIDER A SECTIONS 6-C: Perform the re-assembly and sealing of the units once delivered to the site. Once re-assembly is complete and signed off by the vendor, the Contractor shall per-

form the air leakage testing of the unit onsite, including development of testing plan with the equipment manufacturer. At a minimum the following shall be performed by the Ventilation Contractor and overseen by the Vendor for final signoff.

- i. Air Pressurization test once field assembly is complete. Maximum allowable air leakage shall be 1.0 percent of design airflow at 1.5 times scheduled total static pressure for the air-handling unit as installed.
- ii. Air-leak testing shall be performed by measuring the airflow pumped into (or out of) the unit at the cabinet design operating static pressure. All supply and return air openings shall be sealed along with the air seal at the supply fan to isolate the high and low side of the unit. The air shall then be pumped into (or out of) the unit until the specified leakage rating pressures are achieved. Airflow measurements shall be performed in compliance with AMCA. Standard 210-2007. The testing shall be witnessed by the Owner's Representative. A detailed report, including all data and test methods, shall be submitted.

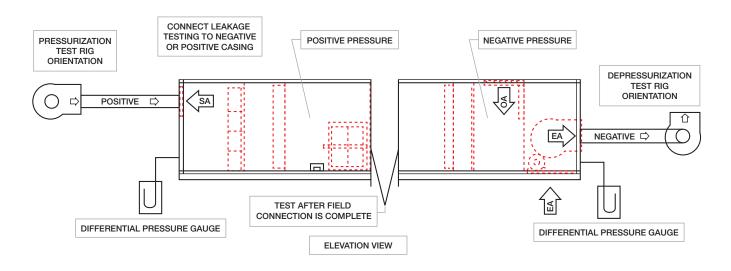
The next step to satisfying this scope is to develop a method of procedure for approval by the project Mechanical Engineering Consultant.

Sample Method of Procedure:

AHU Preparation Example using Oriflow Test Rig:

- Prepare the allowable leakage calculation based on the supply fan total static pressure (TSP) rating times 1.5 or 10 in wg" (the engineer or manufacturer will specify the pressure limit).
- 2. The allowable leakage calculation is the same for the positive and negative test of the AHU case.
- 3. Install the blank-off plate at the openings indicated in the schematic. Use rope caulk to form a removable airtight gasket sandwiched between each blank-off plate and the AHU case surface. Cut a 6-inch diameter opening in the blank-off plate to affix a 6" round sheet metal collar used to pressurize the AHU interior chambers. Drill a 3/8" diameter hole into the blank off plate and insert a small 1/4" rubber hose through the hole and into the air handler case. Attach the opposite hose end to a calibrated manometer to measure interior chamber static pressure during the pressure test.
- 4. Set up the Oriflow pressure testing / flow blower rig. Attached is the test hose between the rig and the affixed 6" pressure test collar. Select

FIGURE 1.



the appropriate orifice plate for the test and install it into the test rig extension tube flange.

- 5. The test rig has two "on-board" digital manometers (pressure gauges). Use one gauge to measure the orifice plate differential pressure. The second digital pressure gauge is used to measure the internal static pressure of the AHU test section.
- 6. For AHUs with 60 percent or more section length being negative, a single test can take place for the depressurization leakage rate. (Please note that a deflection test in a positive pressurization test will likely still be required.) Where less than 60 percent length is measured on the negative side of the fan, perform two tests: one test series on the discharge side and one series on the suction side. Plastic should be rolled out or sheet metal blankets with gaskets applied to separate the sections. Typically, the contractor will cover the inlet of the fan with screw- in sheet metal blanks with gasket.

AHU Case Leak and Pressure Testing:

- 1. With the AHU test chamber prepared for blower pressure testing, slowly introduce air into the chamber using the rig blower fan speed controller on the test rig. Advance the fan speed until the desired test pressure is achieved. Holding the fan speed steady, measure and record the orifice differential pressure. The air flow leakage is either calculated using the orifice plate flow equation (CFM= orifice CFM @ 1" plate differential pressure) or from the orifice plate flow chart) see the Oriflow pressure chart in appendix.
- 2. If the fan speed setting on the pressure and flow test rig is set to maximum speed, but the required case test pressure is not achieved, attach a booster fan to the test rig fan inlet to increase test pressure and flow. The internal static pressure within the AHU case will improve and most likely achieve the required test pressure.
- 3. Since the fan test rig includes an in-line orifice plate flow meter to measure air leakage, the or-



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ifice differential pressure flow calculation, or the flow vs. differential pressure chart (CFM leakage vs. orifice differential pressure.) will be used to determine air flow through the orifice. This is the same air flow leaking through the air handler case. The leakage corresponds to the differential pressure meter measurement as it relates to the chart CFM listed at that differential pressure.

4. If the test flow rate is less than the maximum allowable leakage, the test passes. If the actual flow is greater than the allowable case leakage, the test fails. The team should look for sources of excess air leakage. A fog machine or smoke bomb can be used to visualize escaping smoke from holes and seams. Repair / seal those leak locations to reduce leakage and retest until the leakage rate is below the allowable limit at the assigned test pressure.

There are typically 2 tables provided to establish the case leakage test pressure and the allowable leakage: the Case Testing Criteria and the Test Results Summary Table (see Figure 2). The Case Testing Criteria table for the 270 Park project required a test pressure at 1.5 times

the total static pressure of the unit. So, in the instance of the AHU, that would be a TSP of 4" wc with a test pressure of 6" wc. The allowable leakage was prescribed at 1 percent of the design CFM. The calculation for this allowance is 20,000 CFM multiplied by 1 percent, equating to 200 CFM. The unit is tested at 6" wc on the inlets section and outlet section of the AHU.

While Case Leakage Testing is already becoming more popular in the New York HVAC sector, it is likely that this type of leakage method will be specified in more projects throughout the United States. Built-up air handling units are increasingly adding integration of supply and return or exhaust energy recovery components. This added assembly in the AHU cabinet is inviting more opportunity for leakage resulting from assembly activities and other trades penetrating the casing for control, electrical, and drainage. AHU Case Leakage Testing is an opportunity for the NEBB professional to apply their knowledge and existing equipment toward successful execution of this test scenario. Looking forward, the NEBB certified professional should recognize that leveraging their experience can lead to many more opportunities in a continually evolving field.

FIGURE 2.

Case Testing Criteria Summary Table 1

Supply Fan Unit Section	S F Design TSP (in w.c.)	Target Test Pressure =	Target Maximum Case Air Leakage (1%)						
Design Fan Total Static Pressure	4.00 "wc	20000	x 1% =	200					
**Note: The maximum test pressure for the AHU unit is 6" wc (1.5 x TSP)									

Calibrated Test Instruments Pressure Manameter

Pressure Manometer Shortridge ADM SN: M93438 Orifice dp Manometer Dwyer DM 1108 E43AA

Pressure Blower Rig: Oriflow Compact Cobra

Testing includes AHU case sections using the 4 inch test orifice (see orifice calibration chart)

Test Results Summary Table 2

Case Test	Required Test Pressure	Leakage Allowance		Actual Test Pressure		Oriflow measured orifice dp (in wc)	Actual cfm Leakage	Test Date	Pass/Fail	Test Witness
Supply Fan Disc	Supply Fan Disch. Side		cfm	(+)	"w.c.	"w.c.	0.0			
		-	6.00 target		(target max dp = .44")					
Supply Fan Inlet	Side	200	cfm	(-)	"w.c.	"w.c.	0.0			
			6.00 ta	arget	(target max dp = .44	1")				

Calculations for leakage: (see the orifice charts and calibrated micromanometer calibrations in appendix)

(equation from calibrated 1" diameter orifice chart) (equation from calibrated 2" diameter orifice chart) (equation from calibrated 3" diameter orifice chart) (equation from calibrated 4" diameter orifice chart) CFM Leakage = 13.632*(orifice dp)^.5 CFM Leakage = 54.842*(orifice dp)^.5 CFM Leakage = 134.70*(orifice dp)^.5 CFM Leakage = 304.89*(orifice dp)^.5



Q&A NEBB Across the Generations

Since 1971, NEBB has been serving firms and individuals that deliver high performance buildings and systems. As the premier international certifying association in the building industry today, NEBB thrives as a result of collaboration across various generations that all bring different experiences and perspectives to the table. This time we sat down with NEBB Board of Directors' member Rodney Hinton to discuss his personal journey with NEBB.

The NEBB Professional (NP): What generation do you identify with?

Rodney Hinton (RH): Baby Boomers!

NP: Briefly explain your journey with NEBB: How did you initially get involved?

RH: I became TAB certified in 1991 because I wanted technical training so that we would be recognized as the best in the industry in our market.

NP: What committees or positions have you been involved with?

RH: I've been on the TAB committee under the leadership of Mr. Nick White and on the BET committee under the leadership of Mr. Phil Emory. I am currently on the BOD and EFC.

NP: Was it difficult to find the time to volunteer with NFBR?

RH: Volunteer time is always difficult but is necessary to advance the industry.



NP: How do you feel your involvement with NEBB has been an investment in yourself and your career?

RH: Being involved with NEBB has allowed me to learn from many of the best in the industry including Mr. Dave Bevirt, Mr. George Hightower, Mr. Chester Thomas, Mr. Ron Kidd and many others. They all volunteered their time and invested in me.

NP: What would you like to see included in the future of NEBB to help adapt the association for generations to come?

RH: I would like to see us promote NEBB by educating the end user and building owners/operators that we exist to validate ventilation in the indoor environment. We are currently working on this as a board.

NP: What do you think could help get the next generation involved?

RH: Educating the end users on the value of NEBB Certified Professionals.

NP: What is the biggest challenge for attracting future generations to this industry?

RH: Time!

NP: Is there a way that challenge could be solved?

RH: One possibility would be offering a discount for individuals volunteering and increase cost for those that just use the resources. •





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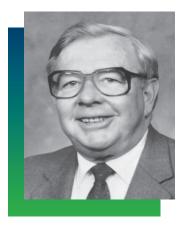


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HONORING THE LEGACY OF ROBERT B. GAWNE

Robert B. Gawne was a man of many talents and passions, but perhaps none were as impactful as his contributions to the National Environmental Balancing Bureau (NEBB). Throughout his life, Mr. Gawne left an indelible mark on the organization, and the building systems industry as a whole, thanks to his tireless dedication to excellence and his unwavering commitment to professionalism.

Born in 1928 in Chicago, Mr. Gawne attended Notre Dame University where he earned a degree in mechanical engineering before becoming a Captain in the U.S. Marine Corps. Beginning his mechanical engineering career at Chatelaine, Gauger & Nolan FAIA in 1953, he then joined Stromberg Metal Works, Inc in Beltsville, MD in 1958 as an estimator. He purchased Stromberg Metal Works, Inc. in 1987 and served as CEO.

As a founding member of NEBB, Mr. Gawne's contributions to NEBB were many and varied, including serving numerous committees over the years. During his time as the Chairman of the NEBB Technical Committee, he worked to establish standards for testing, adjusting, and balancing HVAC systems. Mr. Gawne oversaw the development of

NEBB's certification programs as well as helped to establish NEBB as a leader in the field of building commissioning to help ensure all building systems are designed and installed to meet their intended performance requirements, too.

Throughout his career, Mr. Gawne remained deeply committed to professional development and continuing education. He was a regular presenter at NEBB conferences and seminars, sharing his knowledge and experience with others in the industry. He also served as an instructor for NEBB training programs, helping to train the next generation of building systems professionals.

Mr. Gawne was known for his dedication to excellence and his unwavering commitment to professionalism. He participated in various industry organizations, including NEBB, SMACNA, MCA, ASHRAE, and the State of Maryland HVAC Review Board, taking time to improve standards such as the rewrite of SMACNA (National) Low Pressure Duct Construction Standards - 1976 Edition.

As a member of the Sheet Metal Local 100 member of JATC, he served as Chairman of the Apprentice Committee, Trustee of Local 100 Trust Funds and Co-Chairman of the Local 100 Scholarship fund. In addition to serving as NEBB President from 1987-1988,

he also served as President of the Washington, D.C. Chapter of Sheet Metal Contractors and as a Director for the Board of MCA of Metropolitan Washington. Additionally, Mr. Gawne received numerous awards and honors throughout his career, including SMACNA Sheet Metal Contractor of the Year and Legislative Contractor of the Year. Suffice it to say, Mr. Gawne was highly respected by his colleagues and peers-and his long list accolades proves it.

Passing away in 2018, Mr. Gawne leaves behind a legacy of innovation and leadership that continues to inspire and influence the building systems industry. The impact of his work with NEBB, Stromberg Metal Works, and the entire HVAC industry, continues to be felt today. Mr. Gawne's contributions to NEBB, in particular, were recognized recently.

"Mr. Gawne always said, 'If there's one thing you ever do, always take care of NEBB.' He would tell me that all the time. NEBB had a special spot in his heart," Darren Aley, Grandson-in-law of Robert B. Gawne and Vice President of Comfort Control, reflected.

Kathy Bigelow, Daughter of Robert B. Gawne and CEO of Comfort Control, mentioned, "I look at it now, the National Environmental Balancing Bureau, and it's not just national anymore, it's international. You have chapters and people in Australia and Puerto Rico and Egypt that use these standards."

To honor Mr. Gawne's immense dedication to NEBB, the Robert B. Gawne NEBB Training and Education Center was unveiled at NEBB's Grand Opening event May 11, 2023.

Phil Emory, 2023 NEBB President, expressed, "We are tickled pink to have this facility here at NEBB. Having the Robert B. Gawne NEBB Training and Education Center here means we can focus on training all day long."

"To come here today and see a new center with his name on it, where people can come and get the tools that they need to make it better, make the construction better, make the balancing better. He would be very humble, grateful, proud," Tish Suhr, Daughter of Robert b. Gawne and Vice President of Stromberg Metal Works stated.

"This is an opportunity for NEBB to offer high-level hands-on training to meet our mission statement as an association and to raise a level of our certification," explained Tiffany Meyers, NEBB Executive Vice President.

"It would have meant a lot to Mr. Gawne because he felt very strongly about giving people the tools that they needed to get their education and training to be able to have successful careers. So, to see something in this format that people can train and learn, that would've meant a lot to him. And it means a lot to us," adds Jamie Palermo, Grand Daughter of Robert B. Gawne and Vice President of Comfort Control.

As we remember Robert B. Gawne and his many contributions to NEBB and the industry with the grand opening of the Robert B. Gawne Training and Education Center, we are reminded of the importance of excellence, professionalism, and dedication in everything we do. May his commitment to professional development and continuing education serve as a model for all those who follow in his footsteps.



By Jeff Schools

he Robert B. Gawne NEBB Training and Education Center held its Grand Opening on Thursday, May 11, 2023. The NEBB celebration in Gaithersburg, MD was well attended with representation of all NEBB committees and disciplines.

It was great to have members of the Gawne family at the Grand Opening event, including Robert Gawne's wife, Patricia. Other Gawne family members in attendance included Kathleen Bigelow, Tish Suhr, Bill Gawne, Jamie Palermo, and Darren Aley.

"This center is the culmination of a lot of work. A lot of hard work and effort. And we really couldn't accomplish this without all the effort and all the people have put into it. It's a fantastic facility. Anybody coming here is going to be rewarded educationally," stated Mike Peak, NEBB Board and Building Enclosure Testing Committee member.

As you can imagine, this project took a lot of time and effort. It also depended on the help of many to bring the project to fruition. Past President Don Hill was the one who put the pencil to the paper and came up with the drawings that were used to build out the space. The training center includes equipment and systems that every NEBB discipline will be able to utilize for practical training.

NEBB Marketing Committee Chair Allen King has also been very instrumental in helping to obtain the equipment and services needed to complete the project. In fact, Allen has moved on to the next phase in acquiring heat exchangers, condensers, and labor to build out the hot and chilled water systems.

We would like to thank the many vendors who have supplied materials, equipment and/or labor to the project starting with Stromberg Metal Works and Comfort Control. These two instrumental firms provided the sheet metal work and labor for all the systems.

There are so many to thank. Soham Neupane and IMI Hydronics donated the balancing components, Ryan Kern of Cummins-Wagner donated the B&G Pumps and John Payne of W.E. Bowers provided the labor to construct the Hydronic Wall. NEBB Commissioning Committee member Victor Gomez from Mechanical Air Concepts, a NEBB Certified Firm, built the control panel at their office in Florida and traveled to Gaithersburg to install it along with the controllers for the VAV System. Sean Boland of Boland Trane was able to donate the condensers being used for the hot and chilled water systems as well as get us the air handlers that serve the VAV and Cleanroom Systems at cost. Mike Dolphin from Young Regulators donated the control dampers used in the Cleanroom. Mike Wieder of Air Filtration Management, a NEBB Certified Firm, donated two Fume Hoods. One is set up as constant volume and the other variable volume. Pete Secor of Evergreen Telemetry has continued to donate testing equipment that will be used by various disciplines. Jack Duffy from Retrotec has provided the equipment that will be used in our Building Enclosure Testing lab and Mike Aleksich from Dwyer has donated the magnehelic gauges that will be used in the Cleanroom area.

It is nice to know that we have industry partners who stepped up and contributed to this project. NEBB would like to thank all these donors for their generosity.

"We will be able to teach every discipline we have, both in a classroom setting and hands-on with equipment in hand, testing systems that are here with every discipline we do," explained NEBB Immediate Past President Jon Sheppard.

This is only the beginning for the training center. As we move forward and start to put it to use, I can foresee the technical committees coming up with other things that we may need to add to keep up with the industry.

THANK YOU!

NEBB expresses immense gratitude to all those that made the Robert B. Gawne NEBB Training and Education Center possible.

















MechanicalAir CONCEPTS











Mike Kelly from the Fume Hood Committee: "We're really excited to have the new training center opening. It's really going to enhance our hands-on training with our practical's, because we're going to have a variable airflow volume fume hood, along with the constant volume. We'll be able to do complete training and testing. So, it's going to be a huge upgrade from what we got."



























Mike Peak from the Building Enclosure Testing Committee:

"Here at the training center, we're able to do practical hands-on training now. With the equipment that we've had donated from the Retro-Tec company, it has added so much value to our training course to be able to have the hands-on training involved with it, so the guys can come in here and actually do the test, perform the test since it's such a new industry."











hope that you will join us here in

our testing lab soon."



Jeff Schools, NEBB Technical Director: "I can't wait to see where the technical committees take it and how they use it. And it's still evolving. Anything else that they may come up with that they need, if it fits, it has to be done, then by all means we'll add anything on it that's needed."















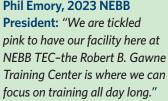


Brian Keller from the Commissioning Committee:

"Bay four is where we have **HVAC** and automated logic control systems set up. So, when you come in here to do your training and all your commissioning and TAB work, you'll be on this equipment."











Instrument Changes for the 2024 Recertification Cycle

By Jeff Schools

Every year before recertification starts, we query the Technical Committees to find out if there are any changes that need to be made to the current discipline Required Instrumentation lists that are on the NEBB website. This year, there will be changes made to the Sound, Vibration, CPT Option-2, and Retro-Commissioning instrument requirements. Here is a summary of these changes:

Sound Instruments

- Remove anything on the Master List that pertains to Real-Time Analyzers
- In Appendix A 2.0 Notes:
 - 1. Add Smart Phone Note
 - 2. Remove Vibration notes and add them to the Vibration Instrument Requirement Sheet

Vibration Instruments

- Add notes that were removed from the Sound Appendix A - 2.0 Notes to the Vibration Instrument Requirements Sheet as notes #9 and #10
- Under Accelerometers / Transducers add "or greater" after Measurement Range = +/- 20 G Peak
- Vibration Note #9, change "No Longer" to "NOT"
- Frequency Resolution delete (Bandwidth)

 Frequency Range - change to "at least 1 to 1000 Hz (60 to 60,000 RPM)"

CPT Option 2

 Remove the sentence, "A Low Output (defined as one which supplies of < 5 x 10-9 particles / min of ≥ 0.3 um in size) or a normal output generator may be used."

Retro-Commissioning

• The Range and Accuracy for the Carbon Monoxide (CO) Data Logger has been changed from a Range of 0 PPM to 1000 PPM to 3 PPM to 1000 PPM and an Accuracy of +/- 3 PPM to +/- 7 PPM. Background: The Lascar CO meters with a range of 0-1000 Range that was being used cannot be recalibrated. Lascar makes a new CO meter, EL-USB-CO, that has a range of 3-1000 PPM. This is the new value that will be added to the Instrument Requirement List along with increasing the accuracy from +/- 3 PPM to +/- 7 PPM. That way, both the new and older Lascar meters meet the requirements.

These changes will be found on the Instrument List (Effective January 1, 2024) when it is placed on the NEBB website before the next recertification cycle begins. •

2023 NEBB Annual Conference

October 26-28, 2023



Challenging the Next Generation





MESSAGE FROM THE PRESIDENT



Welcome to the 2023 NEBB Annual Conference.

Welcome!! Welcome to the 2023 NEBB Annual Conference and Monterey, California!

Monterey is rich in history, maybe not as old as the east coast, but well worth noting. Founded in 1770 by Spain and Mexico, Monterey was the original port of entry for all goods to California and became the capital of Alta California. Monterey is home to California's first theatre, public building, public library, public school, printing press and newspaper. Many of the structures still stand today – just follow the walking tour outside the hotel, but keep an eye out for the naïve turkey wandering the streets.

My selection criteria for the NEBB annual conference location was to find a small town, preferably on the coast, with excellent shops and restaurants within easy walking distance of the hotel, great golf venues, and of course for me, a microbrewery or two. Monterey checked every box.

So please enjoy the venue. Visit the shops, restaurants, aquarium, take a whale watching tour, play a little golf, and toast another successful year of NEBB.

Last year's conference was full of energy, great speakers, great vendors, and great networking on so many levels. I hope this year's conference can build on the momentum set from last year. Enjoy the conference, see and hear what's new in our industry, and discover what some of our new NEBB CPs are bringing to the table. Their youth and energy are exceeding all expectations.

I thank all of you that have supported me this year as NEBBPresident and the time you have given NEBB.

Thank YOU!!

(DE)

Phil Emory NEBB President





2023 NEBB CONFERENCE SCHEDULE AT A GLANCE

TIME	MONDAY - OCTOBER 23
8:00 am – 5:00 pm	TAB CT Seminar - Registration Required
	TUESDAY - OCTOBER 24
8:00 am – 5:00 pm	TAB CT Seminar - Registration Required
	WEDNESDAY - OCTOBER 25
8:00 am – 5:00 pm 8:00 am – 5:00 pm 8:00 am – 5:00 pm 12:00 pm – 6:00 pm 7:00 pm – 10:00 pm	TAB CT Seminar and Exam – Registration Required NEBB Exam Day – Registration Required Closed Committee Meetings Annual Conference Pre–Registration Open Volunteer Appreciation Dinner – Invite Only
	THURSDAY - OCTOBER 26
7:00 am - 6:00 pm 8:00 am - 2:00 pm 10:00 am - 1:00 pm 1:00 pm - 5:00 pm 4:00 pm - 5:00 pm 5:30 pm - 6:45 pm	Annual Conference Registration and NEBB Store NEBB 25th Annual Golf Tournament – Registration Required Guest Event: Whale Watching – Registration Required Exhibit Hall Hours NEBB Past President's Meeting – Closed Opening Session: Welcome and Keynote Presentation Keynote Speaker: Jenn Donahue Get Acquainted Reception – Full Conference and Guest Registrants Only
	FRIDAY - OCTOBER 27
7:00 am – 8:00 am 7:00 am – 4:00 pm 7:00 am – 5:00 pm 8:00 am – 3:30 pm	Breakfast Annual Conference Registration and NEBB Store Exhibit Hall Hours Technical Track Sessions TECHNICAL TRACK SESSIONS
8:00 am – 9:30 am	Track 1: NEBB TAB Procedural Standard 9th Edition TAB Report Compliance Track 2: CPT/IAQ: The Challenge with the Challenge Track 3: Q&A with YPN: Insights and Perspectives from Young Professionals in the NEBB Industry
9:45 am – 11:15 am	Track 1: TAB WB Heat and Heat Transfer Track 2: It Is All About Containment and Seeing is Believing Track 3: Retro–Commissioning HVAC Systems and Engineering Controls with an Aerosol–Based Challenge Methodology
11:15 am – 12:15 pm	NETWORKING LUNCHEON





2023 NEBB CONFERENCE SCHEDULE AT A GLANCE

TIME	FRIDAY - OCTOBER 27 (continued)
	TECHNICAL TRACK SESSIONS
12:15 pm – 1:45 pm	Track 1: WB Fluid Mechanics
	Track 2: Cleanroom Air Change Rate Optimization with VisionAir Clean
	Track 3: Compliance Affairs and NEBB Certification: Bringing Clarity and Understanding to Certification Requirements
2:00 pm – 3:30 pm	Track 1: Data Analytics for New Cx, Retro-Cx and Beyond
	Track 2: Going Digital in Cleanroom Monitoring to Meet Your Customers Contamination Control Strategy
	Track 3: Proper Usage and Limitations of Air Flow Capture Hoods With Non–Standard Airflow Inlets and Outlets
	SATURDAY - OCTOBER 28
7:00 am - 8:00 am	Breakfast
7:00 am - 2:00 pm	Annual Conference Registration and NEBB Store
7:00 am - 6:00 pm	Exhibit Hall Hours
8:00 am - 1:45 pm	Technical Track Sessions
	TECHNICAL TRACK SESSIONS
8:00 am - 9:30 am	Track 1: Beyond the Simple Fix – Advanced Troubleshooting and Analysis of Hydronic System
	Track 2: How Do All The NEBB Certifications Interact With Each Other
	Track 3: Improving Work Relationships: Using Polite Argument™ to Enjoy Your Job
9:45 am - 11:15 am	Track 1: Enhanced HVAC Air Water Instrumentation Technology Recommendations
	Track 2: How a NEBB Professional would approach ANSI / RESNET / ICC 380-2019:
	Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and
	Airflow of Mechanical Ventilation Systems
	Track 3: Achieving Optimal Performance: Understanding Hydronic Balancing, Pump
	Optimization, and Balancing Strategies for Efficient Hydronic Systems
11:15 am - 12:15 pm	NETWORKING LUNCHEON
	TECHNICAL TRACK SESSIONS
12:15 pm - 1:45 pm	Track 1: How to Correctly Measure Air Flow for Commercial Kitchen Grease Hoods Using
	Standard TAB Instruments
	Track 2: TBD
	Track 3: How Employee Engagement Drives Company Growth
2:30 pm - 3:30 pm	Town Hall - Full Conference Registrants Only
3:30 pm - 4:00 pm	Closing Session - Full Conference and Guest Registrants Only
4:00 pm - 6:00 pm	Vendor Reception - Full Conference and Guest Registrants Only

SUNDAY - OCTOBER 29

8:00 am – 12:00 pm Board of Directors Meeting – OPEN



Located on top of the central utility plant (CUP), we made our way to the refrigeration exhaust system fan. Once we arrived at the place where we would be taking our readings, we set up our equipment. Next, we drilled and prepared for a Pitot Tube Traverse. We put the variable frequency drive (VFD) in hand mode.... nothing happened.

This particular exhaust fan serves a room containing the new chiller that serves a new hospital. The system was designed to operate in the event of a refrigeration leak.

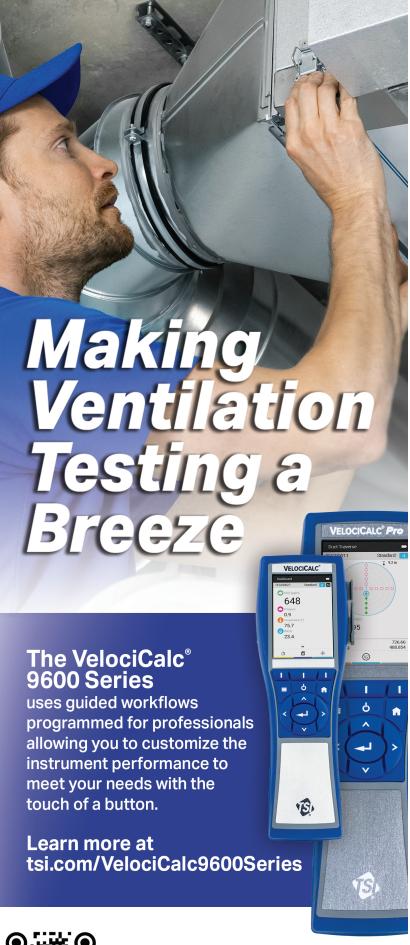
Once we realized the fan did not turn on, I called the control person for the project. They continued to tell me that they had no control over the system, so I then called the General Contractor we were working for. The GC connected with the facility engineers, who also informed me that they had no control over the system.

After discussing this with the mechanical contractor also working in the CUP, and continuing to work on it another hour or so, I was told that they could jump the alarm out. Once he did that, the system turned ON! And we headed back to the place where our traverse was located.

Conveniently, the VFD was next to the duct, installed on the wall. But then we discovered...30 hz! That's it. The fan wouldn't run over 30 hz. We took a traverse and the fan was low on flow. We tried to put the fan at 60 hz, but it would not ramp up that high.

With years of experience, I found myself scrolling through the options and realized the VFD was locked out at 30 hz.

Having made many friends throughout this industry, I called one I refer to as "the "drive guy." He helped me unlock the drive, and we were able to get the drive to



go up to 60hz. We then tried another traverse. We got to 50 percent of design flow, and I had a hunch that the fan was running backwards.

Finding ourselves tracking down facilities to unlock the locked ship ladder located on the back of the CUP, we headed up to the roof to locate the fan, remove the cover, and verify whether the fan was running backwards.

As it turned out, we had to call the electrician to switch the direction of the fan. He finally arrived, and to his disbelief, I showed him the fan was running backwards. He switched the wires within the drive and put it back together.

We took our traverse again, and to my disbelief, the fan was still only exhausting 50 percent.

I headed back to the roof, but quickly realized the ladder had been locked back up since I had told facilities we were done. After tracking facilities back down to unlock the ladder, I headed over to the fan, removed the cover, and found that the fan was still running backwards.

I called the electrician again, and he refused to believe me-until he spoke to his apprentice. After discussing it with the apprentice, they realized the wrong side was switched. They arrived to redo what was done previously and switch the correct side of the drive. After that was complete, we turned the system back on and took our traverse. Finally, we were making design flow!

Long story short, a few-hour job turned into an all-day affair due to one person not verifying direction at start up. After that experience, I would highly advise anyone to verify direction prior to the start of any work. This goes for all mechanical equipment.

After that experience, I would highly advise anyone to verify direction prior to the start of any work. This goes for all mechanical equipment.





Chapter News Great Plains NEBB

Meredith Carr

Following the Great Plains NEBB board meeting last quarter, events were added to the chapter's calendar. Held June 26-27, the TAB Certification Training was a success.

This fall, the chapter will hold the *Annual Great Plains Recertification Seminar* from September 21-22. The first day will include a networking happy hour and dinner at J. Rieger & Co., while the second day will consist of a day-long seminar at the Sheraton Crown Center.

Those interested in attending chapter events should contact Meredith Carr at greatplainschapter@nebb.org or 785-230-0454.

Mid-South EBB Chapter

Ginger Slaick

Mid-South EBB (MEBB) is celebrating 50 years (1972-2022) of service. Join us at the 2023 Recertification Seminar and Vendor Expo, September 23^{rd} - 24^{th} at the Hotel Ballast in Wilmington, NC to celebrate this incredible milestone. We look forward to celebrating the success of the chapter and the individuals who have contributed to our success. Be on the lookout for more details about registration, hotel accommodation, and CECs for CPs and CTs. For now, mark your calendar and plan to attend!



Practical Exam site update: We are happy to announce that construction on the Mid-South practical exam site in

Columbus, GA is complete! We have submitted the required documentation to the TAB Committee for its review and approval. Once we receive official notice from NEBB that the site has been approved, we will announce the date(s) of the first practical exam(s) to be offered at the Mid-South facility. This endeavor has been a long time coming and wouldn't have been possible without the time and dedication of our many volunteers! Special thanks to Scott Kleback, Travis Stuck, Thad Routh, Mark Andrews, Joel Shannon, Scott Goller, Chris Goff, Ken Doyle, John Dachenhaus, Billy Bivins III, Brandon Caves and several others for making the Mid-South practical exam site a reality!

Rocky Mountain NEBB Chapter Shandre Guy

Rocky Mountain NEBB (RMNEBB) held a chapter business meeting on April 07, 2023 in Denver, Colorado.

The RMNEBB Board of Directors discussed the upcoming 2023 RMNEBB 49th Annual Seminar refresher courses for the continuing education of NEBB Certified Professionals and NEBB Certified Technicians. Stuart McGregor (Engineering Dynamics), Sound and Vibration Committee Chairman and NEBB Certified Professional Seminar Instructor will present Sound Measurement Certified Professional Training. Brian Sharkey (Airadigm Solutions), NEBB TAB Committee Member and NEBB Certified Professional Seminar Instructor will present the TAB Certified Technician Technical Training. Donald Pittser (JEDI Balancing), NEBB Board of Director, TAB Committee Chairman and NEBB Certified Professional Seminar Instructor will present the TAB Certified Professional Training.

The RMNEBB practical exam training lab updates are continuing and should be completed mid summer 2023. RMNEBB will post its practical exam dates for fall and winter 2023 once the updates are completed.

We are looking forward to the NEBB Annual Conference in Monterey, California October 26-28, 2023. RMNEBB Chapter will be represented by Shandre Guy, Chapter Coordinator; Kevin Shaw, Chapter President; Tim McLean, Technical Committee Chairman; Stuart McGregor, NEBB Sound and Vibration Committee Chairman; Donald Pittser, NEBB Board Member and TAB Committee Chairman; and Brian Sharkey, NEBB TAB Committee Member.

NEBB Canada

Beverly Girard

We are excited to announce that NEBB Canada has just celebrated its 37th anniversary this year!

NEBB Canada held its recertification seminar on May 12 in Montreal, QC, only 7 months after its last one in October 2022. This time, the chapter tried something new by having both virtual and in-person attendees at the same time. Overall, it was a great turnout and success. There was even a portion in which in-person attendees were given the opportunity to travel to an onsite training facility where they were shown the basics of Fume Hood Testing, as well as

Tracer Gas Testing. Thank you to Preston Phipps for that opportunity.

We would also like to thank all of our speakers for participating, including Luis Chinchilla from NEBB National, and for providing everyone with news and updates from the NEBB headquarters! In addition, we are grateful for our vendors, including Dwyer, Evergreen Telemetry and Chevrier, for their participation both in-person and virtually!

If you are interested in attending and/or speaking or being a vendor at any future seminars, please reach out to our Chapter Coordinator at info@nebb.ca.

Our President, Reg Hofmann, has announced that he is stepping down as Chapter President for personal reasons. We potentially have a new president lined up at the moment, but will make the final announcement once confirmed.

We are happy to report that our Board Member who had suffered a traumatic life event has recovered (and is still recovering) fairly well and was able to attend our recertification seminar virtually! It was so nice to see him there!





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