

# The NEBB Professional

2016 – Quarter 4

## COVER STORY: THE YOUNG PROFESSIONALS OF NEBB

- Building Enclosure Testing (BET) Seminar
- Resonance in Centrifugal Chillers
- The Evolution of the Digital Pressure Gauge
- NEBB Annual Conference Heads to Orlando
- Continuing Education: Friend or Foe?
- Preparing to Sell Your Business? Seven Key Variables to Consider
- Why Should I Calibrate?
- Eight Millennial Weaknesses and How to Overcome Them
- NEBB News
- NEBB Committee Reports

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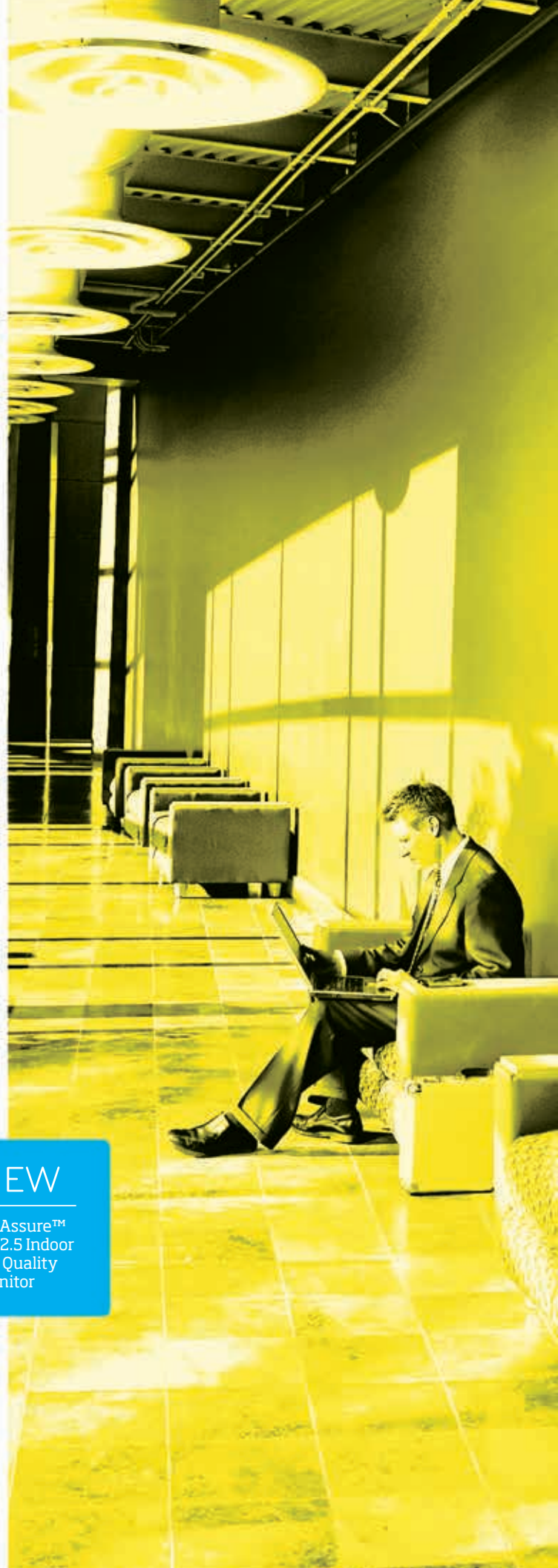


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### Corrections in *The NEBB Professional* Quarter 3 2016

In *The NEBB Professional's* feature article "The Women of NEBB," Ms. Alice Wan San Yong from TecnicAire Services Sdn Bhd was incorrectly identified as a CPT Certified Professional. Ms. Yong is a CPT Certified Technician. We regret the error.

In the NEBB Certified Firms, Professionals and Technicians listing, Williams and Urns Contracting Pty Ltd was incorrectly identified as being located in Canada. The firm is located in Australia. We apologize for the error.



The views, opinions and conclusions expressed in this publication are those of the authors and do not necessarily reflect the official policy or position of NEBB.





## President's Message: Annual Conference Headlines NEBB's Training and Education

**By: Jim Kelleher**

I am honored to have been selected by the Board of Directors to be NEBB's president for 2017. Beginning with the October meeting in Salt Lake City a fast-paced 12-month term is underway. Experience has shown the time will pass by quickly and I believe this to be true considering all the activities that go on within our organization. A President's opportunity to leave his mark is very limited and I hope that my message of *training and education* will fit nicely into the period we are coming through where our focus was necessarily placed on revamping our certification programs. One thing is NEBB is an organization that will continue to prosper year after year due to the hard-working staff and volunteers and I hope we can contribute to make 2017 another banner year for NEBB. I see this opportunity to serve as NEBB's president a privilege and continue to be thankful to be a part of the process by which NEBB operates.

NEBB's volunteers are industry experts and this is recognized by the way we operate technical committees, exam development committees, the Certification Board, and the Board of Directors. The premise being that those closest to the action and those with the most experience can provide input and careful insight into the direction the organization follows. That is the process we have – that is what makes NEBB such a great and dynamic organization. The officers and directors will come and go but the developed policies and procedures that guide us through the ever-changing nature of our industry are built on the foundation established by technical experts in their tradecraft. There is always some change in an organization such as ours but with a thoughtful and planned track to follow we can grow NEBB to meet the needs of the stake holders and industry we serve.

A tremendous amount of thanks is owed to Jean-Paul Leblanc for all his efforts and accomplishments while serving as NEBB's 2016 president. With his guidance to staff and as chairman of our Board of Directors, NEBB has had another successful year. The recent accomplishments in the arena of certifications, publications, and our newly rolled out management software definitely kept us directors on our toes this year, and thanks to JP and our valued staff we managed to keep our projects on track and continue to meet the expectations of our affiliates.

We all recognize what a success NEBB has become in the industry over the last several years. Not a single one of us is responsible for this -- it is due to the combined efforts of all those involved in the process day in and day out. Success is measured in many ways but just take a look at the quality of everything NEBB you have been receiving lately and judge for yourself and I think you will agree. NEBB is making a difference in the industry and you have a lot to be proud of when you affix the NEBB logo to your projects, correspondence, and advertising. And we want to continue to get even better. Tell us what you need, step up and volunteer if you can, and share our progress and developments with your customers and other industry folks – NEBB IS making a difference!

As of this 2016 fourth quarter edition of *The NEBB Professional*, a tremendous effort has been underway in preparing for the annual conference in Disney Springs™ – Orlando, Florida. Like many of you, I look at our conferences as a great opportunity to reunite with colleagues, learn about new products from our exhibitors, gather new information and education from our technical sessions, and often take away some inspirational thoughts



from our keynote and closing speakers. Until these past few months, I never took the time to think “*How does all this happen?*” Well, let me tell you it is a feat by our staff and volunteers who must cover everything from venue selections, to technical programming, to committee meeting organization, and yes – to food selections. Currently we are working on the technical programming and details will be released as they become available through our marketing efforts. Rest assured you will see a great training and education format with key speakers from across many areas of our industry. Beginning with our keynote speaker Robert Stevenson and ending with our closing speaker Ryan Jenkins and stocked full in between with 21 presentation across three tracks – you’ll have to bring help to cover all the bases. Looking forward to seeing you all in Orlando for NEBB 2017—“The Science of Buildings: Operations, Performance, and Testing.”

## Past President’s Message: A Look Back at 2016



**By: Jean-Paul Leblanc**

Dear Colleagues:

Fall has arrived.

By the time you read this issue of *The NEBB Professional*, 2016 Quarter 4, the NEBB Board of Directors fall meeting will have taken place. New board members will have been elected and a new president will be in place.

This year, our fall Board Meeting took place the end of October in beautiful Salt Lake City, Utah. This meeting marked the end of my year as the 2016 NEBB president. Our incoming president, Jim Kelleher, is the NEBB leader since the end of the fall meeting.

Jim will be an excellent president. I had the pleasure to work and collaborate with him during my year-long term and for many years before. Jim has the NEBB logo tattooed on his heart. He will be a great leader for 2017.

It was an exciting year for me. It provided me the opportunity to live very closely with the evolution of this organization. After all the efforts that were put together by my predecessors, I felt like NEBB really got into the 21st century and I was able to live and participate in this transition.

Our national office is staffed with highly competent and professional individuals who bring their skills, hearts, and souls in a totally devoted fashion to NEBB. We are still looking to fill a few key positions. By the time this magazine is published, chances are good that other highly qualified employees will be working in our upgraded location.

Let me brief you on various activities started in 2016 (or earlier) that are coming to maturity.

1. Bodies of Knowledge (BoK) are now becoming a standard document for all NEBB disciplines. Each discipline is either currently governed, or will be in the near future, which means better understanding of the discipline from the start, with consistency and synchronization between the development of the training curriculum and the development of the discipline exam. Everyone will be working from the same BoK.
2. The Certification Board is now fully staffed with highly competent and committed professionals who are moving the certification agenda forward. The addition of Subject Matter Experts (SMEs) allow the Exam Development Committee to really focus on projects like the BoK and prepare exams that are related to

the BoK. Appropriate fire walls are in place to prevent any cross-pollination between the various sub-committees forming the Certification Board.

3. NEBB is proud to announce that the TAB CT exam is now available in metric on Kryterion for all our certification candidates. We need to acknowledge the participation of our friends from Australia, the leaders of that metrication process, and the representation from various countries, including the U.K. and Canada. Everyone involved was very active in this process. Thanks to all of the volunteers who worked countless hours to get this exam available. The next exam to be metricated is the TAB Certified Professional (TAB CP) exam, currently underway.
4. The ANSI process for the CxPP is ongoing and the accreditation is slated for 2017 first quarter. It is a long process. Our Certification Director and the Certification Board are working very closely with our consultant (PTI) to polish and complete this process and present the completed application to ANSI for the accreditation of the CxPP program.
5. Since July, NEBB's BSC Standard is under public review and once the review period ends, submitted changes will be made. In 2016 fourth quarter, this Standard will be our first ANSI Standard published. Thanks to the Standard Council Team and Secretariat for their hard work.
6. Our new database (Certelligence) is operational, permitting all chapters and affiliates to access and know their status in real time 24/7. This is a major improvement in our certification process and allows NEBB to keep its leadership role in line with the strategic planning of the organization.
7. NEBB's Young Professional Network is slowly unfolding and I am excited to see the interest that this program is creating among our Millennial participants. They need to be involved in NEBB. We need to listen and help them find their place in NEBB. Now is the time for them to get involved. They will have a forum where they can discuss, exchange, and promote their ideas. We need to encourage them to get involved in all aspects of the organization. They are the future of NEBB. Let's help them take their place and feel at home.
8. NEBB is expanding into a truly international organization. We have affiliates from the world over and in almost all disciplines. This international flavor is felt in our relationships and exchanges with other foreign organizations. They want to know NEBB and they want to get involved with us. We need to pursue this exposure but we also need to make sure those other organizations know how stringent it is to be part of NEBB. Quality craftsmanship is non-negotiable.

This is only a very limited and very brief sample of activities that have, or are, taking place in the organization.

Being your NEBB president for 2016 was a great life experience. It was a privilege and a pleasure to serve this wonderful organization. I extend a very special thanks to all the volunteers working countless hours, days, nights, and weekends for the betterment of NEBB.

Thanks to our wonderful staff, always listening, supporting, and helping our volunteers accomplish their tasks. They are also working countless hours. Without this magnificent team cooperation and complicity, NEBB would not exist. NEBB volunteers and our staff are the heart and soul of NEBB. We must never forget this reality.

Thank you very much to all our chapters and affiliates who are dedicated to this organization. Chapters are the basis of this organization and we must recognize their contributions.

A special thanks to my family and wife Monelle who have always been very supportive of my activities.

Finally, Jim—you have my full support for your 2017 presidency. It will be a great pleasure working with you for this coming year.

Thank you all.

# The Young Professionals of NEBB

**Bert Henderson | AZS Consulting**



Theodore Roosevelt is quoted as saying, “Old age is like everything else. To make a success of it, you’ve got to start young.” Growing a successful association for the 21st century, NEBB is formulating the ability to survive into the next millennium through a coordinated plan of attracting younger colleagues into the organization.

According to a strategic white paper titled “Engaging Young Association Members” by the Association Laboratory, while young professionals want to help an organization, they typically don’t want to be part of the traditional structure. They want to feel empowered and not micromanaged. A group of young professionals provides volunteers that can help the mission of an organization, but unlike older associates, they don’t want to come to a meeting and leave. There’s a social aspect they’re expecting. They like to have their meetings in unusual places like backrooms in bars, small venues, and restaurants.



**Jean-Paul Leblanc**

Taking on the goal of bringing younger associates into NEBB is Jean-Paul Leblanc, CEO, Hydrauliques, R & O Services, Montreal, and NEBB’s immediate past president. “NEBB needs to encourage our existing younger professionals to get more involved in the organizational structure of NEBB,” says Leblanc. “We want to encourage our existing young professionals to go through the ranks of being a corresponding member, then a voting member, move onto the Board of Directors, and eventually become the president of NEBB. We need to look at these young people for their different perspectives. The young professionals bring newer and fresher ideas to the organization and will help NEBB to grow and prosper into the future.”

NEBB exists with small firm owners who do mostly testing, balancing, and related work on advanced mechanical systems. Leblanc described what a visit to the NEBB conference looks like: “When you go to the conference and conventions, the people attending produce a huge sea of gray hair,” he says. “All you have to do is sit down and look around in a

general session at the conference and see the aging population of NEBB—the proof is obvious.”



**Eric Jenisen**

According to Leblanc, not too long ago the American Society of Heating, Refrigerating and Air-Conditioning Engineers, (ASHRAE) successfully started a small group for young professionals. Leblanc is working with Eric Jenisen, NEBB Marketing Committee chairman, and Olaf Zwickau, NEBB Marketing Committee member, to put a plan in place to attract young professionals into NEBB. Zwickau, Jenisen, and the Marketing Committee are really excited about this new assignment and have jumped on the project. “We are in the early stages of this issue,” says Leblanc. “Research is underway to provide me with a proposal to properly and successfully implement a plan of action.”

This new generation of young professionals have grown up in a different social order than what older folks are used to. These generations are the first age groups that have not known a time when there wasn’t an internet. Their perceptions of our global community are vastly different than the typical older generation in our society.



**Olaf Zwickau**

“We use Instagram, Snapchat, and other internet services to communicate,” said Olaf Zwickau, NEBB CP, USA Balancing, president/owner. “We certainly do not pick up the telephone and communicate. We either email or use social media for all of our communications.”

“The younger professionals are using technology slightly more than the older generation,” says Nick Postolache, NEBB, CP. “Most NEBB certified professionals today have to use technology to provide a good service to their customers. The younger professionals are using on-line services like websites, online articles, blogs, Twitter, LinkedIn; the younger professionals are participating in linking with their peers more than their older colleagues. I can see the younger people taking a picture of a marked-up drawing and con-



verting that to a pdf with an app rather than the old way of taking the large drawings to a print shop for scanning or copying. The latest technology comes in handy for the newer people who are eager to use an app to make their jobs easier. Younger or older, they all have to use technology to compete in today's market."



Robert Linder

Robert (Bob) J. Linder, P.E., LEED AP, CP, director Performance Group, Karges-Faulconbridge, Inc., was the youngest NEBB president in the history of the association. As a past president, Linder reflected, "When I became engaged with NEBB in about 2000 as a young associate, I was very fortunate that I had some mentors who were heavily involved with the organization. Fred Menger took me under his wing and opened my eyes to the global community," Linder said. "I was working locally in Minnesota in a big city doing many things within a very large circle of professionals, but when I got engaged with NEBB I realized that all these seasoned professionals in the organization were doing work and had contacts all over the country and the world. They leveraged their relationships for knowledge and business growth. They were the people who helped me better understand the global nature of our business."

"As a young professional, one of the things that was quickly recognizable to me was the way people accepted me into the NEBB organization, how they were interested in my views, and their interests in helping me grow both personally and professionally. I found that very refreshing," Linder said. "I discovered that NEBB is a place where individuals can quickly make a difference. You didn't have to spend exorbitant amounts of time making political-style relationships before you could be appreciated for the value you brought to the table. I found that interesting and that helped motivate me to participate more in the organization."

"As I looked at all these people that I was working with when I was NEBB president, like Fred, Jim Bochat, Jerry Bowers, and the others on the different committees, I felt like these very successful people in the industry valued what I brought to the committees and the larger organization that really made me feel good about what I was doing," said Linder.



Nick Postolache

"The NEBB structure is very solid," Postolache said. "NEBB adheres to strict standards and provides professional recognition. I think most of the young technicians and professionals want to belong to an organization with good ethics and continuing education requirements. Young professionals from the outside may

*"As I approve of a youth that has something of the old man in him, so I am no less pleased with an old man that has something of the youth (within). He that follows this rule may be old in body, but can never be so in mind."*

Marcus Tullius Cicero

see that their input is not needed. They may feel that their input will not make a change in the NEBB structure. I think that may be why some of the young professionals may not be actively engaged in volunteering with NEBB. I think that can be changed. NEBB is taking the first step by getting more proactive in engaging the young professionals in the organization. That is a great move. NEBB wants the younger professionals to step up and be a part of NEBB because NEBB needs them in the fabric of the organization."

"As a volunteer organization, I think the structure of NEBB works very well," said Linder. "The office staff work in concert with the associates to help them be successful. The traditional structure of NEBB is still efficient in absorbing new ideas, concepts, and philosophies rather than being old and stoic. NEBB can react to the industry very quickly and that in turn helps NEBB to better serve the firms, organizations, and professionals who get our certifications."

According to Linder, as president he chose to do what he could to recognize and promote younger people, not over anyone else, but by trying to help the younger associates recognize that their contributions had value and would be listened to quickly. That point displayed to the younger associates that you didn't need gray hair, or meet certain criteria, or get to a certain level, or have years in the organization to get their ideas heard or acted on. "I had many conversations with people who were surprised at my ability to be in a leadership position within the organization and I found that very refreshing," Linder stated. "I think that energized some participants to become active because they realized there were opportunities for them. We also have to step aside and let others take over just like people stepped aside and let me take a leadership role."

To meet the desire for a variety of meeting places, Linder said that he thought NEBB did a great job designing meetings to fit everyone's needs. There are large open town halls, small meetings, social gatherings, vendor areas, and the way the break sessions are designed, NEBB has the opportunities for everyone to be in their comfort zone. NEBB meetings are a place where everyone is welcome and made to feel comfortable.

"I think that NEBB meetings are efficient in the way they deliver new courses and the way they get the professionals up to speed with changing industry information," Postolache

said. “Besides the technical courses, I enjoy the coaching speakers who provide me with better ways of doing my day-to-day activities. I would welcome more contact with the other members of NEBB during the annual meetings.”

“During my discussion with the Marketing Committee, we picked up a mention for a mentoring process to be included in the organizational design of our ‘Young Professionals of NEBB Program’,” said Leblanc. “There is already a session planned for our 2017 conference to make sure we give the young professionals an opportunity to build their own session and learn from each other. Those who formed this organization must understand that we have to be attractive to this age group of professionals. They have a different outlook on life and our society. We must remain attractive and give this new group space, room to move to express their own ideas, and to have open doors to allow this idea exchange. We’re in 2016 and the world is changing. NEBB has to be flexible and change to remain alive and succeed into the future. NEBB needs to keep this issue on the front burner all the time. We need to keep this alive and promote NEBB’s openness to the young associates. NEBB should have a standing committee of young professionals to provide a guide to the Board of Directors with ideas as the organization moves forward.”

“We ask the young professionals in the HVAC community to come and join our organization and ask that they show us what they are capable of doing for the organization,” Leblanc said. “NEBB has their rules and regulations that must be followed, but the younger professionals might be able to demonstrate – by working a little differently – some new concepts, processes, or ways to do things that will benefit all of us.”

“The change in our certification programs that we are putting into place for individual certifications, and opening up our organization helps attract younger professional into our organization,” Linder said. “Our programs are going to be more accessible for the younger generation. People worldwide see the value of NEBB’s programs because they teach a hands-on technical approach to work rather than a sit back and fill out some forms in a book or do the job remotely process. The people who really want to make a difference in our industry and are willing to get dirty appreciate the types of things that our organization is involved in and the level of knowledge we provide in our educational endeavors.”

“NEBB has to facilitate its young members in connecting with each other and to present the value of not only being a member, but being an active member,” said Postolache. “Having new ideas discussed in small group settings and bringing the results of their discussion to the Board for review and acceptance. That will likely keep the young

members interested and involved. NEBB has to maintain and continue a culture that is open to constant change.”

“NEBB must show the younger professionals that there are opportunities to grow within the organization,” said Zwickau. “Give them opportunities to be leaders inside the NEBB charter, show them pathways to spearheading committees – that would make them feel more engaged.”

What kept Linder involved in NEBB was the mentorship, the openness, and the interest the more seasoned professionals took in him. They were truly interested in what, how, and why he did what he did. “That is something that all of us in the organization need to understand and give back,” Linder said. “Making the organization welcoming is more than any formal program or approach that has been put in place.”

“Taking the articles that appear in *The NEBB Professional* magazine and putting them online not only on the website, but also on LinkedIn, or other social media, where young professionals would be able to make comments and share their experiences or views about a particular article, would provide a vehicle to encourage more young professionals to take an active role in the organization,” Postolache said.

“The work life balance is important to the younger generation and going to a two-hour meeting for professional growth at the end of the day is not always as high a priority for them,” Linder said. “Families and other activities take a precedence. We need to recognize that and make sure we capitalize on the other technologies we can use to demonstrate the value of the relationships in the organization.”

The continuing success of NEBB depends on the volunteers who are part of the organization and NEBB is looking to the future of its constituency and its growth by reaching out to the next generation. ■

## About the Author

*Bert Henderson, M.Ed., APR, is a consultant with AZS Consulting in Gainesville, FL, for sustainability, renewable energies, and did cutting edge “green” building product research with AZS. He is a national speaker in sustainability and writes and delivers professional training programs in sustainability, renewable energies, and “green” construction for utilities, building contractors, HVAC contractors, renovators, tradesmen, building officials, architects, professional engineers, building inspectors, interior designers, and homeowners in all aspects of sustainability, energy efficient design, and building construction.*

*Bert is also a retired Energy Extension Faculty with the Programs for Resource Efficient Communities at the University of Florida (UF) and was the lead building science faculty for the Bushnell Center for Sustainability at UF.*

# Building Enclosure Testing (BET) Seminar

Seminar Location: Hilton Lake Buena Vista @Walt Disney World Resort, Orlando, Florida

Seminar Registration Deadline: Monday, March 13, 2017

Seminar Dates: Monday & Tuesday, March 27 & 28, 2017, 8:00 am – 5:00 pm

Optional BET Certified Professional Exam Day:  
Wednesday, March 29, 2017, 8:00 am – 2:00 pm

Building Enclosure Testing (BET) is an important and growing field in our industry. It addresses a distinct need within the building and construction industry—the ability to test and quantitatively and qualitatively report the performance of the air-tightness of today's building enclosures.

**This BET seminar has been awarded 15 continuing education credits by NEBB.**

BET is a process involving evaluation, verification and documentation that a building's design and construction meet defined performance expectations. In addition to fewer water leakage/mold issues for both new construction and renovation projects, BET results in better building energy performance through improved thermal performance and decreased air leakage issues.

## Who Should Attend

- Professionals looking to become familiar with BET
- Architects, engineers, building commissioning agents
- Building owners, operators and facility maintenance/management personnel
- Building facility, building auditors and safety professionals
- Energy auditors
- Technicians and managers experienced in BET who are seeking to become certified in this discipline

## Learning Objectives

This two-day seminar provides Attendees with an overview of BET concepts including:

- Discussions of air barrier enclosures from design to material selection and installation
- Review of various testing methods and procedures currently specified and their correct application
- Basic operation of the blower door equipment, respective applications and features will be presented

- How to analyze and trouble shoot enclosure test issues
- Trouble shooting air barrier leakage issues and problem resolution focusing on the use of thermal imaging

## Instructor

Chairman of NEBB's BET Committee, **Phil Emory** is a graduate of Montana State University in Mechanical Engineering and is the Senior Project Manager for Neudorfer Engineers. He has been involved in the Washington State engineering and construction industry since 1985. His experience includes Mechanical Design, Mechanical Construction, Test & Balance, and Air Barrier Testing and is a ASTN Level II Thermographer. Emory has tested over 200 buildings with over five million square feet of envelope. Currently he serves on the ABBA Whole Building Tightness Committee and is co-author of the NEBB BET Procedural Standard.

## Seminar Schedule

Seminar hours are from 8:00 am - 5:00 pm each day, with a one-hour lunch and am/pm breaks.

## Recommended Readings

Attendees should have a working knowledge of:

- *ASTM Standards: ASTM E 779, ASTM E 1827 and ASTM E 1186*
- *NEBB Procedural Standards for Building Enclosure Testing - 2013* (Download free or order hard copy from [www.nebb.org](http://www.nebb.org) )
- *USACE Air Leakage Test Protocol for Building Envelopes*

## Important Reminders

1. **Registration deadline is Monday, March 13, 2017.**
2. Enrollment is limited. Registrations will be filled on a "first come-first served" basis.
3. Seminar fees include course instruction, lunch, and am/pm breaks.
4. Seminar fees do not include anything pertaining to eventual certification.
5. Registrants will receive a confirmation letter, including instructions regarding required seminar materials.
6. Questions? Call 301-977-3698 or email [training@nebb.org](mailto:training@nebb.org).

**To register and for more hotel and travel information, go to [www.nebb.org](http://www.nebb.org) and click on Events.**



# Resonance in Centrifugal Chillers

**Kevin Gaghan | Gaghan Mechanical, Inc.**



Chillers that seem to vibrate during random periods or continuously during normal operation probably will not be correctable by normal rotating balancing methods. This type of vibration may be caused by the equipment as a whole, or a particular piece of that equipment being excited to its natural resonance frequency. To simplify natural resonance, think of a bell or a tuning fork. When you hit the bell or tuning fork it will vibrate at its natural resonant frequency which is exhibited as a sound, a bell ringing. This is not exact, but is used as an example to make this type of resonance more understandable.

## Scenario

A customer complained to a maintenance service contractor that the centrifugal chiller was vibrating and had been since it was originally installed in 1990. The mechanical room had four identical chillers with parallel piping to all four chillers off common headers for the chilled and condenser water. Only one of the chillers had this vibration issue. The other two major issues concerning this chiller were: 1) about 10 years ago a leak was found on the chiller where the motor bracket mount attached to the machine, and 2) the chiller was converted to new refrigerant with the motor and starter replaced with up-graded controls in 2012.

## Procedures to Determine Source of Vibration

1. Collected available documented history on the chiller from the service company as well as from the operating engineers. Then I interviewed the service contractor personnel involved with this chiller and spoke with the operating engineers who had used this equipment since installation.
2. Surveyed the mechanical room for isolation of the chillers and piping. Looked for differences between any of the four chillers. In this case, no differences were found between any of the chillers. The isolators under the chillers were identical, properly loaded, and functioning properly. It was noted that none of the piping connected to the chillers were not isolated (no in-line piping isolators). This was later determined not to be a contributing factor in the vibration during normal operation of this chiller.
3. Collected actual vibration data during air run operation of the chiller (the refrigerant had already been removed from the chiller in preparation of chiller teardown and suction piping removal). Impact testing of the motor casing, suction piping, chilled and condenser water piping was performed with suction piping on and off the machine. This was also done with the motor mount bracket tightened, as well as with the motor mount bolts loosened. All of these readings were then analyzed to determine the next course of action to make a final determination for remediation of this vibration.
4. Analysis determined that the motor casing had a natural resonance frequency that was excited at the motor operating speed because the natural resonance of the motor casing was at motor operating speed.
5. The fix was to change the natural resonance frequency of the motor casing. The service contractor then moved the chiller overhaul gantry to a spot over the chiller motor. This was used with a two-ton chain fall to provide upward force on the motor casing. The same chain fall was then used with straps around the chiller barrel to provide downward force on the motor casing. In each of these scenarios, impact testing was performed on the motor casing to determine which direction of force would have the greatest change in reducing the natural resonant vibration of the motor casing. The end result of these readings was that the motor casing needed to have a continuous upward force applied to maximize the change of the motor casing natural resonance frequency.
6. The next step was to send the information to the equipment manufacturer with the recommendation of upward force on the motor casing. It was re-

quested that the manufacturer design a new type of motor mount gusset to distribute the load properly across the chiller barrel.

7. This was then forwarded to the building engineer for consideration.

## Conclusion

The end result was that the operating engineer declined this particular remediation/repair as he wanted all four of his chillers to look identical. The near term result of that decision was that the building engineer changed the chiller to a brand new replacement chiller (same manufacturer). The longer term result is that the other three chillers were changed to be identical with the first new chiller, so that the building had four identical chillers.

In this particular case the recommended remediation repair was rejected for whatever reason the customer deemed appropriate. This type of resonance problem is not very common, but will create a lot of heartache for the customer and unjustified blame to the mechanical contractor. Manufac-

turers are cognizant of resonance issues, and are careful to avoid these types of problems in their equipment. Very occasionally it occurs, but most likely not the fault of the manufacturer. Most times (keep in mind this is a relatively rare occurrence) it can be caused by additional equipment attached to the system, improper isolation of the equipment, and/or piping.

In today's energy efficiency world, the use of variable frequency drives is becoming common on all types of mechanical rotating equipment. These drives can operate with output frequencies up to 120 Hz. This opens up a more frequent possibility of any piece of equipment and/or attachments to that equipment and system operating and being excited to create a natural resonance frequency vibration. This natural resonance frequency can be avoided in most variable frequency drives which will allow a certain number of skip frequencies to prevent the equipment from operating at speeds that will excite the natural resonant frequencies of the assembly. This can be determined by use of proper vibration testing equipment. ■

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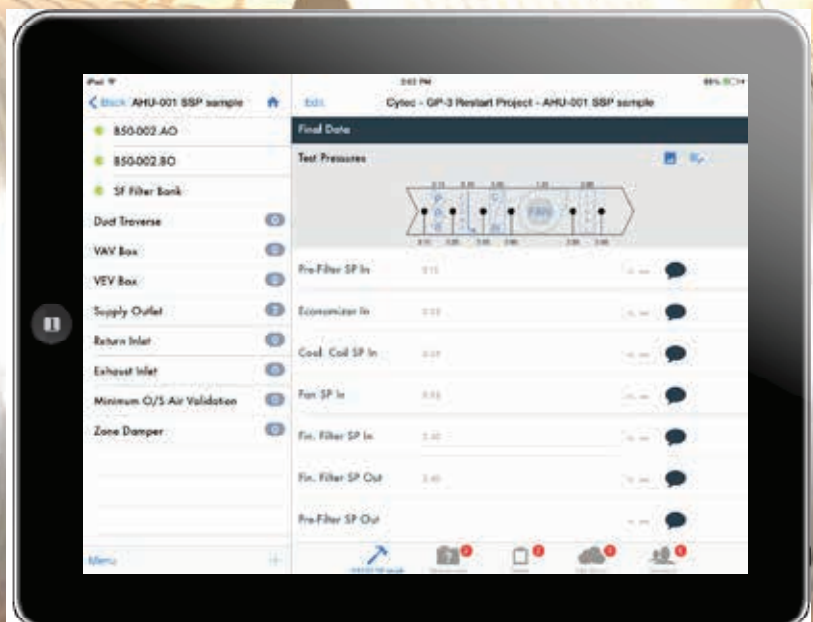
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# The Evolution of the Digital Pressure Gauge

**Frank Spevak | The Energy Conservatory**



From mercury and liquid to crystals and computers, pressure gauges have evolved dramatically since the 1600s. Five scientists set the foundation for technology in today's gauges with their discoveries over a 200-year period. Today HVAC contractors are equipped with knowledge and tools to measure pressure and offer data-driven recommendations that help clients make energy-efficient decisions for their buildings.

In high school science class we learned about the discoveries, observations, theorems, and laws that led us to a modern understanding of pressure. But for many of us, that was quite a while ago.

Pressure constantly surrounds us and resides within us in various forms. In the mid-17th century, physicists started to explore what pressure is, how it disperses, and how we can measure it. We can thank five famous scientists for our modern understanding of pressure: Evangelista Torricelli, Blaise Pascal, Christiaan Huygens, Daniel Bernoulli, and Henri Pitot.

These great minds used early experiments related to transporting water to set the foundation for the modern electronic instruments that are now commonplace. Many heating, ventilating, and air-conditioning contractors rely on the results from these experiments every day they are on the job.

## Origins of Pressure



**Evangelista Torricelli**

The first of our five famous scientists is Evangelista Torricelli, an Italian physicist and mathematician. Torricelli is credited with the development of the first barometer in 1644. The name derives from two other words –

baro for weight and meter for measure.

The barometer is an inverted tube of mercury under vacuum, placed in a base pool or reservoir of mercury. As atmospheric pressure is exerted on the reservoir of mercury, the column of mercury in the tube rises and falls. By placing marks on the column, the “weight” of air could be measured for the

first time in history. Torricelli's barometer is known as an “unvented single liquid column manometer.”



**Blaise Pascal**

The second of our famous scientists is Blaise Pascal, a French mathematician and physicist. Pascal's great discovery was that pressure is evenly displaced within a vessel. This means when pressure is introduced inside a containing device, like a jar, pressure measurements on one side of the jar are equal to pressure measurements on the other side of the jar.

To translate this concept for today, if we add air into a house or building with a fan, then the pressure on the west side of the building will be the same as pressure on the east side. For the moment, we'll put aside other atmospheric conditions such as wind.

Both Pascal and Torricelli are so important in the world of pressure measurement that units of measure have been named after them. The Torr is named after Torricelli and the pascal (Pa) after Pascal.

## Fluid Mechanics

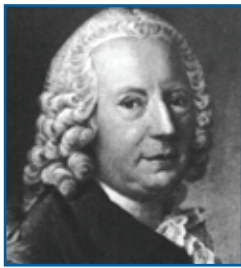


**Christiaan Huygens**

Our next discoverer is Christiaan Huygens, a Dutch mathematician and scientist. Huygens is credited with the invention of the liquid column or u-tube manometer, not related to the internet service for watching videos. The u-tube manometer differs from the

barometer in that the u-tube can be vented to atmosphere or connected to another source of pressure. When there is no pressure difference from one side of the column to the other then the value is zero. Once pressure is applied to one side, then the liquid is forced down one side and up the other making it possible to measure force.





### Daniel Bernoulli

The next person on our list of famous inventors is Daniel Bernoulli, a Swiss mathematician and physicist. Bernoulli came from a family of scientists with an impressive 10 relatives contributing to our understanding of various aspects of science.

Bernoulli was mostly concerned with fluid mechanics. The main theory he created that we use today is that an increase in the speed of a fluid occurs simultaneously with a decrease in pressure. Bernoulli's theory explains many everyday occurrences such as how airplanes fly and why curveballs happen in baseball. When it comes to measuring air flow in ductwork, Bernoulli is sitting with each HVAC technician who uses a Pitot tube, an invention named after our fifth scientist.

### Henri Pitot

Henri Pitot, a French hydraulic engineer, is credited with the invention of a tube that mixes the theory of Bernoulli with the invention of Huygens. Instead of an unvented u-tube, the sides of Pitot tubes are connected to pressure ports that point into the direction of air flow and perpendicular to the air flow. With Pitot's invention, we are able to measure the Bernoulli theory because when pressure on the side increases, the flow moving along the duct decreases.

## Mechanical Instruments

A number of advances in measuring pressure occurred in the decades and centuries after these scientists made their discoveries:

- Bourdon tube: A sealed, curved tube that straightens as pressure inside the tube increases. A needle movement is attached to provide a measurement.



Bourdon Tube

- Bellows and diaphragm gauges: Bellows-type gauges use the expansion or contraction of a folded membrane to determine pressures while a diaphragm gauge uses the expansion or deflection of a membrane to determine pressure. These gauges measure the mechanical action as pressure is applied.
- Magnehelic® gauge: A helical gear is attached to a diaphragm to move a needle.

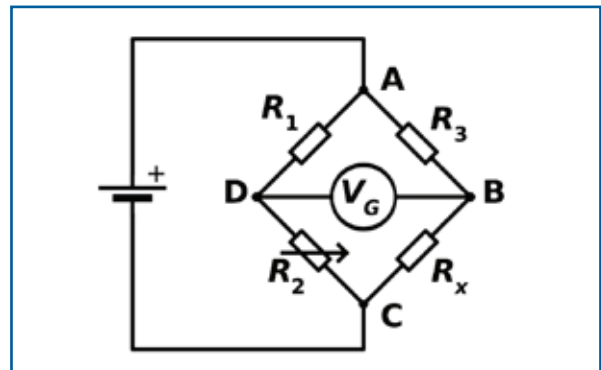
Liquid and mechanical gauges have served a variety of industries in a very wide range of applications. These devices were scaled up and down for various pressure values suited to the respective industries. These types of gauges have their limitations, however, because it is difficult to attach an electrical lead to a liquid or mechanical gauge.

This left us with gaps in our knowledge, such as how do measurements get transmitted elsewhere in an office or factory, and how can we record and store information from a liquid device?

The answers came when inventors figured out how to measure an unknown electrical resistance.

## Electrical Resistance to the Rescue

In a completely unrelated field in the early 1800s, inventors were working to solve a different mystery of measurement. The question was how to measure the resistance of an unknown electrical component. The answer was to use three known legs of an electrical circuit to measure the unknown fourth leg. This concept was developed by Samuel Christie in 1833 and was later improved upon by Sir Charles Wheatstone in 1843. The circuit became known as the Wheatstone Bridge and is in a staggering number of electronics used every day. In particular, it can be found in a large number of measurement devices, such as resistance thermometers, hot wire anemometers, and strain gauges.



Wheatstone Bridge

Strain gauges have the ability to electronically measure force, making them of great interest to us today. By laying out the Wheatstone Bridge on a surface, then applying force to that surface, there is a change in resistance. The change in resistance is then calibrated against other means of measuring force. The result is a calibrated electrical circuit that measures pressure.

## Pyroelectric and Piezoelectric Effects

In the mid-1800s, one group of scientists determined that temperature can affect electrical generating properties of materials, while another group experimented with the rela-

tionship between electrical charge and mechanical stress. The Curie brothers advanced these experiments with their knowledge of pyroelectric effect of the underlying structure of crystals. The brothers were ahead of their time. These experiments remained in the laboratory as an answer to a question that was not yet asked.

The 200-year period from the mid-1600s to the mid-1800s created wonderful scientific achievements, but the world had to come up with even more inventions and electronics to bring us to today.

## Electronic and Digital Devices



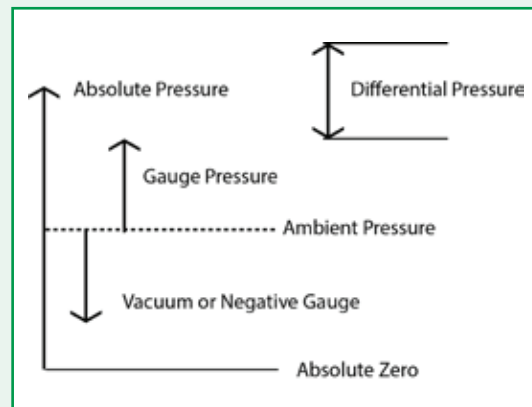
Modern day pressure gauges from 1983 to 2016

In 1906, one of the first practical uses of a piezoelectric device was sonar to detect icebergs. Crystals were layered between two pieces of steel with the Wheatstone Bridge conducting electricity. This combination of steel, crystals, and electrical components detected a returning sound pressure wave. Once this technology proved successful, development and adaptation occurred swiftly. Of course, the advent of computers and various processor technology didn't hurt either.

The ability to develop small, consistent crystals with embedded electrical circuits triggered the digital pressure gauge industry, eventually leading to the advanced microprocessors of today. Modern digital pressure gauges behave similarly to handheld computers rather than devices used solely to measure pressure.

Today's gauges can connect to the internet wirelessly, perform automated tests and export large amounts of data for thorough analysis. They equip contractors with the power to offer clients data-driven recommendations that help conserve energy in buildings.

## Pressure 101



Pressure – normal force per unit area exerted by a fluid on a containing wall with respect to a reference

Absolute pressure – normal force per unit with respect to zero absolute pressure

Ambient pressure – the pressure at which a device operates

Gauge pressure – pressure above or below ambient pressure

Differential pressure – difference in pressure between any two points in a system

Total pressure – pressure on a plane normal to the local flow direction

Static pressure – pressure on a plane perpendicular to the local flow direction

Velocity pressure – net effect of the difference between total pressure and static pressure

Inventions have advanced exponentially in past centuries, but the industry's technology is far from complete. Manufacturers push the envelope of what's possible every day, equipping contractors with the most advanced, accurate, and reliable digital pressure gauges. ■



Today's digital pressure gauges include touchscreen technology and software that continues to incorporate new features

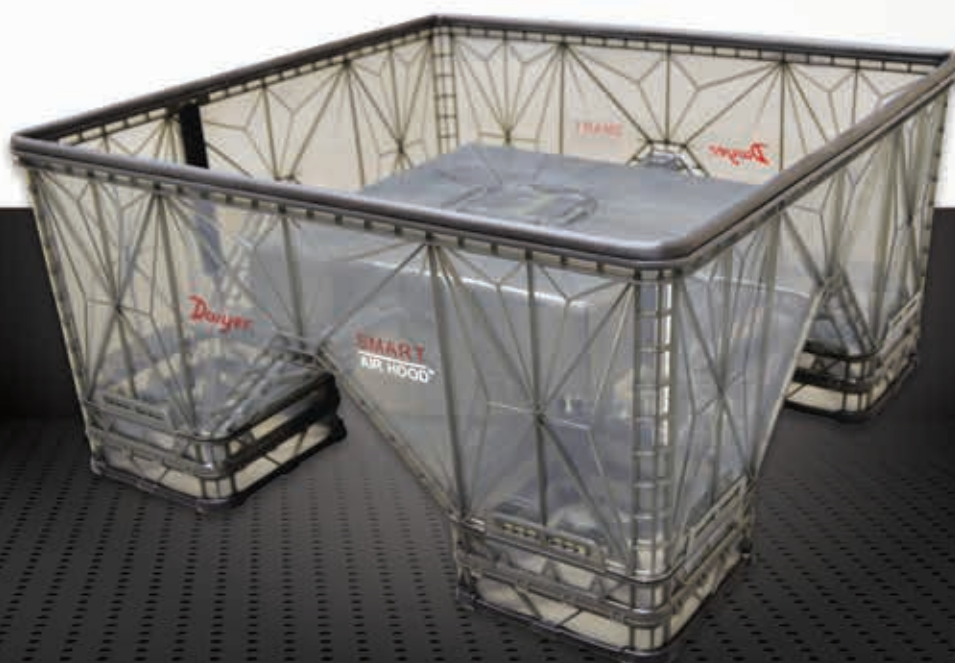
## About the Author

*Frank Spevak has more than 30 years of experience in the HVACR industry with expertise in air and pressure measurement equipment. He is the marketing and sales manager at The Energy Conservatory, a Minneapolis-based company known for manufacturing the Minneapolis Blower Door, the Minneapolis Duct Blaster, and digital pressure gauges.*



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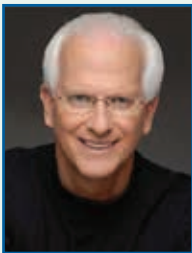
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# NEBB Annual Conference Heads to Orlando

NEBB is pleased to announce that its 2017 Annual Conference will be held at Hilton Lake Buena Vista @ Walt Disney World Resort, March 30- April 1 2017. This year's theme is *The Science of Buildings: Operations, Performance and Testing*.



Robert Stevenson



Ryan Jenkins

The conference will be kicked off by opening speaker Robert Stevenson who has over 30 years of experience teaching companies how to deal with risk, competition, and the ever-changing business environment. Technical sessions will abound throughout the conference which will be topped off by words of wisdom on the Millennial Generation from closing speaker Ryan Jenkins.

Other conference highlights include:

- Exhibitor Display
- 20<sup>th</sup> Annual Golf Tournament
- Vendor-hosted Reception
- Volunteer Appreciation Dinner

Take a peek at the 2017 Annual Conference Schedule:\*

## NEBB 2017 Annual Conference

### Tuesday, March 28

Noon - 6:00 pm	Conference Registration Open
8:00 am - 5:00 pm	Closed Committee Meetings

### Wednesday, March 29

7:00 am - 5:00 pm	Conference Registration Open
8:00 am - 5:00 pm	Closed Committee Meetings
6:00 pm - 10:00 pm	NEBB Volunteer Appreciation Dinner

### Thursday, March 30

7:00 am - 3:00 pm	NEBB 20 <sup>th</sup> Annual Golf Tournament, Lunch and Awards**
7:00 am - 5:00 pm	Conference Registration Open
1:00 pm - 5:00 pm	Vendor Exhibits
11:15 am - 12:30 pm	Lunch for all Conference Attendees
5:30 pm - 7:00 pm	Opening Session, Welcome and Speaker Robert Stevenson

\*Draft schedule subject to change.

\*\*Separate registration required.





Conference  
Registration is  
Now Open!

### Friday, March 31

6:30 am - 8:00 am	Continental Breakfast for Conference Attendees
7:00 am - 5:00 pm	Conference Registration Open
7:00 am - 5:30 pm	Vendor Exhibits
8:00 am - 5:30 pm	Chapter Coordinators Meeting
9:45 am - 3:45 pm	Technical Sessions
3:45 pm - 5:30 pm	Vendor Hosted Reception

### Saturday, April 1

6:30 am - 8:00 am	Continental Breakfast for Conference Attendees
8:00 am - 9:30 am	NEBB Business Meeting and Town Hall
9:45 am - 3:45 pm	Technical Sessions
4:00 pm - 5:00 pm	Closing Session and Speaker Ryan Jenkins

### Sunday, April 2

8:00 am - 5:00 pm	Open Board Meeting
-------------------	--------------------

Set amid 23 beautifully landscaped acres, The Hilton Orlando Lake Buena Vista is within walking distance to Disney Springs™, which features an eclectic mix of unique boutiques, one-of-a-kind eateries and jaw-dropping entertainment. There are four fascinating neighborhoods filled with so much to discover:

- The Landing – A tasty waterside district absolutely overflowing with spectacular flavors.
- Town Center – Unique boutiques, one-of-a-kind flagship stores and a playful promenade that lets you relax, refresh and reconnect.
- Marketplace – From crystal glass coaches to sportswear with a Disney flair, this is one of the most hip Disney shopping experiences around.
- West Side – Ignite your senses with the sound of applause for world-renowned shows and the tempting aroma of treats to be discovered.

In addition, the hotel offers complimentary transportation to and from all *Walt Disney World®* Theme Parks, including: *Magic Kingdom®* Park, *Disney's Animal Kingdom®* Theme Park, *Epcot®*, and *Disney's Hollywood Studios®*

While you're in town, remember to explore all that Central Florida has to offer, including Florida's world-famous beaches on both the Atlantic and Gulf coasts, Kennedy Space Center, LEGOLAND®, and the Everglades.



2017 NEBB  
Annual  
Conference

**Orlando**  
FLORIDA

*The Science of Buildings:  
Operations, Performance and Testing*



# In Memoriam

## John (Jack) Cappell, 2007 NEBB President



NEBB past president John G. (Jack) Cappell passed away August 13, 2016, after a long illness. Cappell was president of Comfort Control, Inc., in Beltsville, Md., and served as NEBB president in 2007. His friend, 2006 president Eric Jenison said of Cappell, “He was an example of the type of tireless volunteers who have made NEBB what it is today, the worldwide leader in TAB and its related disciplines. It was always a pleasure to work with him for the betterment of NEBB.”

Cappell began his career as a Testing, Adjusting and Balancing (TAB) technician for Comfort Control in 1982. He served as president of the company since 1989. Cappell obtained NEBB-qualified status in TAB in 1989. He also had 22 years’ of building systems commissioning experience—a discipline in which Cappell was NEBB-qualified since 1993.

Cappell had a long and extensive involvement in the NEBB organization. He was a member of the NEBB Board of Directors from 1998 to 2006, and served on several NEBB national committees, including the Chapter Affairs and the Executive Finance committees. At the

local level, Cappell active in the Capital-Mar-VA NEBB chapter as Technical Committee chairman, member of the Board of Directors, treasurer, and as president in 1994.

“I hope that his legacy as a NEBB volunteer sets an example for all to follow,” said Jenison.



Jack Cappell speaking at the NEBB 2005 Annual Conference in San Antonio, Texas.

*NEBB is honored to recognize those who contributed to the NEBB organization and the field of balancing and commissioning. Please note that this information is only that which has been volunteered to us by colleagues, friends, and family. Please feel free to email [communications@nebb.org](mailto:communications@nebb.org) to share additional information on a deceased certificant or stakeholder for future recognition.*

# Continuing Education: Friend or Foe?

*Cynthia Hereth | NEBB Director of Certification*



Yes. I know. CECs are the bane of most Certificants' existence. But let's imagine a world where no one took continuing education seriously.

Consider the healthcare industry without continuing education. Let's ponder dentists – better yet, your dentist – who you recently learned, hasn't cracked a book since passing their credentialing board exam or attended a training or technical seminar in over 20 years. They don't know what a webinar is, much less a podcast...and are still using outdated dental techniques, tools and practices. No fluoride treatments. No crowns or caps. No root canals. Yet, your dentist believes they know everything they need to know about modern-day dentistry.

Your dentist purposely left themselves behind while dental trends continued to change. "But why," you ask? Because they felt no need to enhance their knowledge. They know it all.

The reality is the continuing education obtained by your dentist gives you a sense of security. While that person is drilling in your Novocain-frozen mouth, you're staring at those Certificates of Course Completion hung in frames on the wall and you know they're up to par with their knowledge, skills and abilities and can fill that cavity with ease. Without continuing education, the credibility of the dental profession—actually, any profession—erodes away.

Continuing education is a subject on many professional's minds these days – October is the magical month when everyone begins submitting their CECs. Some question the validity, while others are diligent about following the guidelines. Whether you agree or not, continuing education serves a greater purpose and is a necessary part of any proper certification program.

Almost all professions have some form of continuing education which is a mechanism for a credentialing agency to ensure it is producing the best possible Certificants. Continuing

## REACH HIGHER!

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- All conference break activities take place in our Exhibit Area which allows for maximum traffic flow as attendees go to and from various sessions and participate in food and beverage activities.
- A two-hour Networking Reception in the Exhibit Area maximizes Attendees time with you, their product and service providers!
- As an Exhibitor and/or Sponsor, you can attend our educational sessions and learn alongside your peers.

Learn more about exhibiting and sponsorship opportunities by viewing our **2017 Exhibitor Prospectus & Sponsorship Opportunities** guide at [www.nebb.org](http://www.nebb.org).



education is quality control, if you will. It allows a platform to teach innovation, techniques, and improvements, and it's a great marketing tool, if used correctly.

Today there are many sources of continuing education available to NEBB Certificants – be it the Certified Professional or the Certified Technician. NEBB's Certification Board has fine-tuned the Continuing Education Credit (CEC) Policy & Submission Form to allow a Certificant to select from a variety of CEC categories. Choose from live or online events (NEBB or non-NEBB), technical, community or college courses, leadership or governance involvement, speaking or article submissions, safety training, lunch & learn events or vendor events.

For Certified Professionals, 12 CECs need to be obtained during their current two-year cycle. For Certified Technicians, 6 CECs need to be obtained during their current two-year cycle. Check out the sidebar for additional details or go online to download the CP or CT CEC Policy & Submission Guide at [http://www.nebb.org/certified/continuing\\_education\\_credits\\_cecs/](http://www.nebb.org/certified/continuing_education_credits_cecs/).

Getting back to marketing, don't underestimate the residual benefit of CECs. Every one of those Certificates of Course Completion should be regarded highly – frame them, hang them on the wall, post it on your website. Tweet about where you went. Post it on LinkedIn. Differentiate yourself from the rest. Knowledge is power, as the old adage goes.

Continuing education is not meant to be a burden on NEBB Certificants. It is meant to maintain high-quality professionals who are always learning and differentiating themselves from others in the field. Take advantage of this opportunity to grow your own knowledge base and broaden your horizons which keeps you and your certification updated – and not left behind. ■

#### About the Author

*Cynthia (Cindi) Hereth is NEBB's Director of Certification and just celebrated her one-year anniversary with NEBB. An association professional for 30 years, Cindi works with NEBB's Certification Board, Exam Development Committee and Subject Matter Experts to hone, create and expand NEBB's certifications and exams.*

#### **NEBB Certified Professionals (CPs) must obtain 12 Continuing Education Credits (CECs) within their current two-year cycle.**

1. A minimum of 6 of the 12 CECs must be submitted from NEBB events per two-year cycle.
2. CPs may combine CEC opportunities from any Category on the Chart below to achieve 12 CECs.
3. Payment of the non-refundable Certified Professional Renewal Fees is required for recertification.
4. CPs with CECs exceeding the 12 CEC requirement within a two -year cycle cannot "carry over" CECs into their next certification cycle.
5. CPs holding multiple certifications can apply CECs simultaneously to all active NEBB certifications if cycles overlap.
6. CEC activity must be submitted with acceptable documentation attached to the CEC Submission form.

#### **Chapters with Certificants outside of the continental US:**

1. Certificants outside the continental U.S. must follow submission procedures as stated within this Policy document.

#### **NEBB Certified Technicians (CTs) must obtain 6 Continuing Education Credits (CECs) within their current two-year cycle.**

1. A minimum of 3 of the 6 CECs must be submitted from NEBB events per two-year cycle.
2. CTs may combine CEC opportunities from any Category listed on the Chart below to achieve six (6) CECs.
3. Payment of the non-refundable Certified Technician Renewal Fees is required for recertification.
4. CTs with CECs exceeding the 6 CEC requirement within a two -year cycle cannot "carry over" CECs into their next certification cycle.
5. CTs holding multiple certifications can apply CECs simultaneously to all active NEBB certifications if cycles overlap.
6. CEC activity must be submitted with acceptable documentation attached to the CEC Submission Form.

#### **Chapters with Certificants outside of the continental US:**

1. Certificants outside the continental U.S. must follow submission procedures as stated within this Policy document.

# Preparing to Sell Your Business? Seven Key Variables to Consider

**Jeff Kraai | Exit Strategies 360, Inc.**



As a business owner, you know critical decisions require careful thought and planning. When it comes to the sale of your business, few decisions are more absolute.

If you are within two to five years of a potential sale or transition, the process is more complex than just posting an ad online and hoping for the best. There are plenty of things to consider and steps to take as you intentionally prepare your business for sale. Here are a few planning variables as you get ready for your best exit strategy.

## Prepare Early

After 15+ years as a broker, consultant and mergers and acquisitions (M&A) advisor, I have learned that the most significant barrier to a successful sale is a lack of preparation. Many owners expect to receive top dollar and have the process go smoothly with no preparation. That is virtually impossible.

Whether you're focused on maximizing profitability, getting your paperwork in order, cutting costs, or generally getting your business "cleaned up," starting early allows your efforts to take effect, therefore being more noticeable to a buyer.

Waiting to prepare until you actually want to sell means you missed your golden opportunity to enhance the business value. It's simple: the earlier you start the more effect you'll have and this directly translates to a higher business value.

## Understand Adjusted Earnings

Many business owners keep their net profits low for tax purposes. The good news is that businesses like yours in the HVAC industry are not valued based on net profits, but on adjusted earnings. Many owners have never heard of this



term, but it's vital to understand what is driving the value of your business.

In simple terms, adjusted earnings is the total financial benefit to the owner(s) of the business. It is calculated as follows:

$$\begin{array}{r} \text{Net Profit} \\ + \text{Interest} \\ + \text{Taxes} \\ + \text{Depreciation} \\ + \text{Amortization} \\ + \text{One Owner's Salary} \\ + \text{Owner's Discretionary Expenses} \\ \hline = \text{Adjusted Earnings} \end{array}$$

Earnings that have been "adjusted" will account for the owner's salary, as well as their discretionary expenses (those expenses that are not business related). Examples include: personal vehicle payments for the owner and/or spouse, life insurance, health insurance, retirement and charitable contributions, travel expenses, meals and entertainment, along with any other personal financial benefit expensed through the business. The list can be extensive.

Understanding this number and how it is derived is critical toward understanding business value, how a buyer (and their lender) will view your business, and ultimately the key differences between the tangible and intangible value (goodwill).

## Delegate More

I regularly hear comments like, "I can't find good help," "Nobody wants to work anymore," or "It's just easier if I did it myself." The result? You end up working 60-70 hours a week and worse yet, you may still be working in your business, not on it.

Delegating is far more than telling people what to do. This is why earnest attempts fail on a regular basis. It is the art and practice of transferring tasks and accountability to your staff. Done correctly – with proper communication and checks and balances – the results are idyllic: it increases job performance and moral, builds teamwork, alleviates stress, frees up more time for you to be strategic, creates a better company culture, and ultimately helps ensure successful results.

If you are doing too much as an owner, the risk goes up for a buyer and this results in a lower sales price. For most owners there is a direct correlation between learning this principal of delegation and enhanced business value.

If not learned, these limitations will become the biggest hurdle to achieving greater success. When preparing to sell, remember a buyer wants to buy your business, not you.

### Look at Cost Efficiencies

There is no need to wait for a potential transaction to clean up the balance sheet, eliminate “slush” accounts on the profit and loss (P&L), or reduce costs where possible. In the past I’ve had owners look at their insurances, utilities, etc., and by making a few simple calls have saved many thousands of dollars a year. One client saved over \$20,000 a year!

Additionally, look at ways to operate more efficiently or eliminate non-vital expenses. With your focus on spending and expense control, I guarantee you’ll find ways to reduce expenses and increase business value.

### Understand Your Financial Story

In 15+ years of assisting owners, I have observed that most are unaware of their own financial story. Many are familiar with the balance sheet and can explain expenses on a P&L. However, when looking at a three- to five-year history of financials and tax returns, they become lost in the details, unable to explain expense fluctuations, re-categorizations from the P&L to the tax return, or the elimination of expense categories altogether.

Buyers will ask plenty of detailed questions... their CPA, lender, and underwriters will ask dozens more. Having answers builds both buyer and lender confidence; having no (or poor) answers, destroys it. This confidence directly parallels business value.

### Reduce Customer Concentration

Client diversification is far more than a management theory. Ideally, a buyer wants a business with a broad customer base, with no customer accounting for more than 15 percent of gross sales.

This may be unavoidable and is a reality for many businesses. Of course this doesn’t mean your business is not salable, it only means there is more perceived risk for the buyer. The buyer will also consider the longevity of these relationships, the industry and business dynamics, as well as the business’ ability to find a replacement client should the relationship cease in the future.

### Separate Emotion and Reality

During a transition the financial stakes will be at an all-time high. Add to that decades of what it has meant to you and your family to be self-employed and it is easy to see why decisions become emotional. This trap is real and far too

common. At any time during your career, this is one of the most vital times to get educated about selling your business.

Unfortunately, emotional decisions put every other decision at risk. As Jim Collins indicates in his book *Good to Great*, “One thing is certain...you cannot make a series of good decisions without first confronting the brutal facts.”

As you contemplate selling or transitioning your business there is plenty to ponder. As an owner, you’ve always had plenty to think about, so this is not new. Now is clearly not the time to bury your head in the sand and hope for the best.

There are dozens of variables to consider when preparing your business for sale. For this reason, nothing compares to getting educated and learning the steps to properly navigate the road ahead. The knowledge received is a valuable insurance policy for a successful exit strategy. ■

### About the Author

Jeff Kraai is president of Exit Strategies 360, Inc., specializing in the preparation and brokerage of construction-related companies. He can be reached confidentially at 1.800.388.1096 or [Jeff@ExitStrategies360.com](mailto:Jeff@ExitStrategies360.com).

*The above is not the opinion of this NEBB publication or NEBB management, but solely that of the author.*

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*Lihue Base, Yard Improvements*

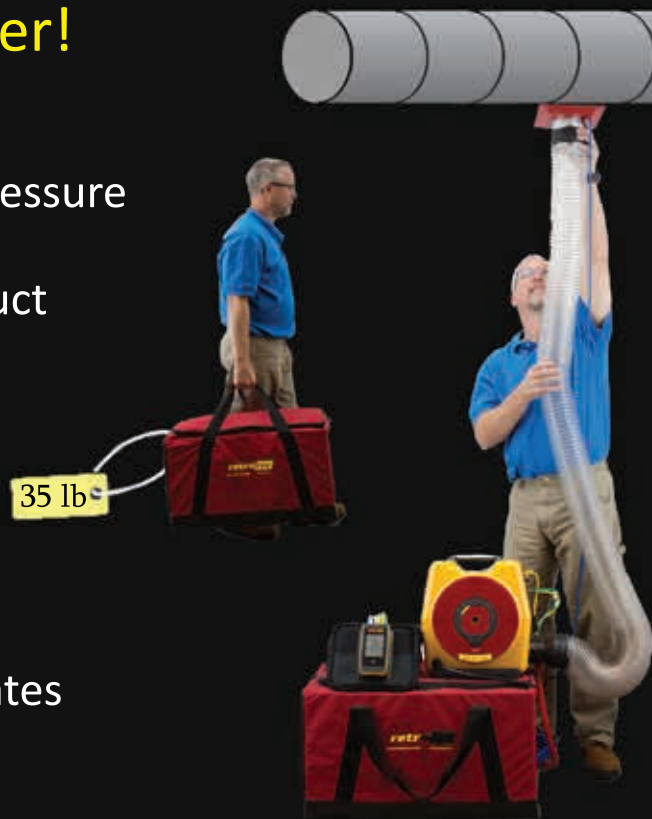
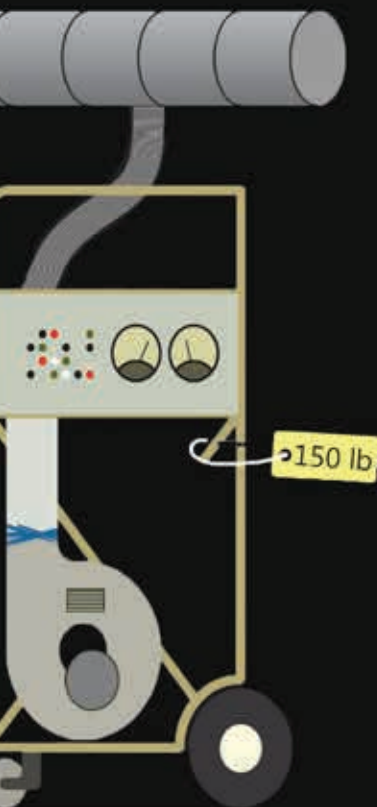
*"On top of the list is the size and lighter weight. It is also very powerful and user friendly. The flexibility of this tester were so obvious that I purchased three."*

*Dave Pauwels, Enviro-Aire /Total Balance Co.*



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# NEBB's California Acceptance Test Certification Program Goes Live

**Jim Huber | Complete Commissioning, Inc.**



NEBB's Mechanical Acceptance Testing Certification Program is now live. Here are some frequently asked questions about the program to get you up to speed.

## What is "Title 24?"

NEBB is an approved Certification Provider for acceptance test technicians and employers under Title 24 of the California Code of Regulations. Often referred to as "Title 24," this program has been in place since 1978 and was originally limited to Energy Conservation Standards for New Residential Buildings. The program was expanded in 1980 to include new nonresidential buildings. NEBB's Certification Program specifically deals with Title 24, Part 1, Chapter 10, Section 10-103-B (2013) or 10-103.2 (2016) – Non-residential Mechanical Acceptance Test Training and Certification. Section 10-103.2 deals specifically with the requirements for nonresidential mechanical Acceptance Test Technicians and Employers and the Certification Providers that train and certify them.

*Often referred to as "Title 24," this program has been in place since 1978 and was originally limited to Energy Conservation Standards for New Residential Buildings. The program was expanded in 1980 to include new nonresidential buildings.*

## What is changing?

Mechanical Acceptance Testing was introduced in the 2005 Energy Standards. The tests are performed to ensure that equipment, systems and controls operate as required by the Standards. These tests include visual inspections, functional testing, and certification requirements. Mechanical Acceptance tests apply to new equipment and systems installed in new construction, change-out or retrofit applications. If an acceptance test is required, the appropriate form along with each specific test is required to be submitted to the AHJ before a final occupancy permit can be granted. Mechanical Acceptance testing under Title 24 has been a requirement



for years. However, the requirement has not been enforced equally among the various jurisdictions. What is changing is that acceptance tests will need to be performed by certified technicians. The requirement for certified technicians will not be mandatory until all participating certification programs achieve a minimum of 300 certified Mechanical Acceptance Test Technicians. As of October 1, 2016, sufficient participation has not occurred so the certification requirement is not yet mandatory.

NEBB is currently providing training and certification based on the 2013 code. The CEC has since approved the 2016 code which goes into effect on January 1, 2017. Additional training that includes the 2016 changes will be online soon; however there will still be a requirement for technicians and employers to hold certification under both versions of the code for the foreseeable future as projects that are permitted in 2016 will still need to be tested under the 2013 requirements even though the testing might occur in 2017 or 2018.

## Why get certified under the NEBB program?

NEBB's Mechanical Acceptance Testing Program includes a modular approach to Mechanical Acceptance Testing Technician Certification. This modular approach allows NEBB to provide certification on a form-by-form basis, thereby allowing technicians and employers who work on smaller projects to only be certified for the equipment on which they actually perform acceptance testing.

### Why get certified now?

The NEBB Board of Directors has established pre-threshold pricing for training and certification for mechanical acceptance test employers and technicians. Once the California certification thresholds are met (expected to occur prior to 2017), the training and test fees are subject to change.

### Who is eligible for Certification?

Eligibility in the NEBB program is open to all qualified individuals and firms. This includes all contractors, consultants, engineering firms, and third-party certifiers. There is no requirement to be a signatory to a union; NEBB accepts both union and non-union employers and technicians.

NEBB Certification as a California Non-Residential Mechanical Acceptance Test Technician is limited to persons who have at least three years of verifiable professional experience and expertise in mechanical controls and systems.

NEBB Certification as a California Non-Residential Mechanical Acceptance Test Employer is open to all employers that meet the requirements for certification. This includes licensed HVAC contractors (C-4 or C-20) and professional engineering firms.

### What costs are associated with the Certification Program?

Fees for Certified Employers include the same annual base fee of \$1,475 per year (pro-rated) paid by all NEBB firms, as well as an annual \$275 program fee. Firms that are already certified by NEBB do not need to pay an additional base fee. The employer application fee is \$20. There is an employer online training fee of \$250, and the employer exam fee is \$250 (any additional retests are \$250 each.)

Fees for Certified Technicians include the same annual certification fee of \$50 per year paid by all NEBB Certified Professionals. There is an application fee of \$20, and a \$40 fee for each entrance exam. There is a Technician online training fee of \$40 per module delivered, and the Technician exam fee is \$40 per exam delivered (any additional retests are \$250 each.) Practical exam fees are dictated by the hands-on training and testing facility. More information on practical exam fees and scheduling can be obtained by contacting Brownson Technical School at <http://brownson.edu/>.

More information on the NEBB program can be found on the NEBB website at [http://www.nebb.org/certified/mechanical\\_acceptance\\_testing/](http://www.nebb.org/certified/mechanical_acceptance_testing/). ■

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# Why Should I Calibrate?

**Bohdan Fedyk | NEBB Technical Director**



The accuracy of devices drift over time and to accurately record environmental values, you must have an instrument that you are certain is correct. The increasing need for known accuracy and less uncertainty has led to the establishment of the National Laboratories, such as NPL in the UK, NIST in the USA, PTB in Germany, amongst others. This has allowed a “traceability” across borders to an internationally defined measurement. All calibrations should be performed traceable to a nationally or internationally recognized standard. Traceability is defined by ANSI/NCSL Z540-1-1994 (which replaced MIL-STD-45662A) as “the property of a result of a measurement whereby it can be related to appropriate standards, generally national or international standards, through an unbroken chain of comparisons.” Traceability is accomplished by always ensuring that the test standards are routinely calibrated against a higher level traceable reference standard.

*NEBB requires a quality management system that includes formal, periodic, and documented calibration of any instruments used for testing and verification in all of its disciplines.*

For continued accurate performance of an instrument, it must be calibrated at minimum within 12 months, unless specifically specified otherwise, with a minimum 3-point calibration at an accredited NIST Traceable facility by a certified technician. A NIST traceable calibration provides an unbroken chain of measurements back to NIST maintained standards, documented uncertainties throughout the chain, and a quality assurance (QA) system to quantify that uncertainty.

Even a new instrument, while it is made to be accurate, requires NIST calibration to verify it is accurate to a specific degree. Calibration compares the measurement of an instrument with that of the standard at which time adjustments may be made to the instrument to match the standard within the stated tolerance or specification. A three-point calibration checks the instrument at near high, mid, and near low points to verify the range since the instrument is used to measure more than a single reading. (Calibration range is defined by ISA's The Automation, Systems, and Instrumentation Dictionary, 4th Ed., 2003 as “the region between the limits within which a quantity is measured, received or transmitted, expressed by stating the lower and upper range values.”)

Instrument error can occur due to a variety of factors: a new instrument, repair or modification, exposure to shock, drift, environment, electrical supply, addition of components to the output loop, process changes, etc. Since a calibration is performed by comparing or applying a known signal to the instrument under test, errors are detected by performing a calibration. An error is the algebraic difference between the indication and the actual value of the measured variable. Typical errors that occur include zero and span errors which are corrected by the calibration procedure by adjustment of zero and span. Even if a calibration procedure does indicate the instrument is within the specified criteria, we would not have known unless it was performed, so the calibration procedure is an important element of any quality system.

Proper instrumentation for a specified task requires calibration but must also meet the criteria for the task specified. While we calibrate an instrument, we need to understand what the properties required for that specific piece of equipment are. There are many terms being used by different individuals and factory literature but much of it is used in-

correctly. The specification for instrumentation requirement identified by NEBB for each of the disciplines lists: “range,” “accuracy,” and “resolution.” The “range” is the upper and lower limits that the values can be accurately measured; “accuracy” is how close the measured value is to the true value of the quantity being measured; and “resolution” of an instrument is the smallest increment the instrument can measure or display. This means that all values in the range indicated can be accurately measured to the accuracy specified with the required resolution.

The main point of the instrument and calibration requirements by NEBB is to make sure all test results are valid and

repeatable to meet the requirement of the NEBB Clients for all disciplines. ■

### About the Author

*Bohdan (Don) Fedyk is NEBB's Technical Director and has been in the industry for nearly 30 years. He is a Certified Professional in TAB, Sound, Vibration, Fume Hood and Building Systems Commissioning. Don says that even though he tries to hide, technology keeps finding him – so for questions on reporting requirements or any other issues, track him down at [don@nebb.org](mailto:don@nebb.org).*

## NEBB's Young Professional Network: Eight Millennial Weaknesses and How to Overcome Them

*Ryan Jenkins*



If you're a Millennial, here's how you can turn what's perceived as your greatest workplace weaknesses into the strengths necessary to be effective as next generation leaders.

As a Millennial speaker who helps organizations better lead, engage, and communicate with the Millennials, my audiences share the good, the bad, and the ugly with me about their Millennial workforce. Below are the top eight shortcomings I've heard over the years and how Millennials can overcome each shortcoming in order to become influential future leaders.

### 1. Poor Work Ethic

Millennials report working an average of 38.8 hours per week, much less than Generation X (47.8) or Boomers (47.1).

“Lazy” Millennials are redefining a strong work ethic. Thanks to technology and the Internet, the tools, rules, and pace of work have forever changed. Both managers and Millennials have to rethink what productive work can and should be in the digital age. Millennials are interested in leaning into technology to work smarter and to find work/life harmony.

**How to overcome:** Work has changed in the 21st century, but the effort, zeal, focus, and respect we inject into work should never change. Millennials who view their employers as their top clients and consider their work ethic the product they deliver will build a reputation of excellence. Anything worth doing is worth doing well.

### 2. Devalue Face-to-Face Communication

Millennial women use texting three times more often than calling.

Millennials' high reliance on technology has resulted in a deterioration of other interpersonal skills. While Millennials have good reason not to answer your phone call, there is still tremendous value in voice communication and, if leveraged appropriately, it can forge deeper connections.

With so many varying communication preferences in today's workplaces, Millennials can stand out by changing the channel and engaging in face-to-face communications.

**How to overcome:** To elevate their influence, Millennials should apply these five rules when engaged in face-to-face communication: Be prepared, present, attentive, concise, and respectful.

### 3. Career Impatience

Seventy-one percent of Millennials are likely to leave a company within two years if they believe their leadership skills are not being fully developed.

Even though work is shifting to more project-based work with shorter turnarounds and timelines, managers continue to wrestle with the unrealistic career advancement expecta-



tions of Millennials. Growing up in fast times and coming of age in an on-demand culture, Millennials have little patience for stagnation, especially when it comes to their careers.

**How to overcome:** Millennials who gain early clarity surrounding their career progression inside their organization will be able to adjust their expectations and explore cross-collaboration opportunities to gain more experience and to put their anxious ambition to good use.

## 4. Frequently Job Hop

Sixty-six percent of Millennials expect to leave their organizations by the end of 2020.

Job hopping isn't the resume red flag that it once was. Job hopping into the same industry and position over and over again is the new red flag. Job hopping into new industries or positions can simply reflect Millennials' desire to gain transferable skills to thrive in today's fluctuating marketplace.

**How to overcome:** Millennials who set clear goals and objectives with specific timelines during the first few weeks of a new job will be better equipped to justify and execute a job hop. Mary Ellen Slayter, a career expert at Monster.com, says to avoid stints of less than one year. Before hopping, notice how green the grass is under your feet before looking over the fence.

## 5. Dependent on Feedback

Millennials want feedback 50 percent more often than other employees.

It's not surprising that Millennials want frequent feedback considering they grew up gaming, which immersed them in constant feedback loops. Now that technology has enabled vast and fast connection, real-time feedback will become more of a workplace norm.

**How to overcome:** Millennials who take feedback into their own hands and exercise self-reflection on their past performance will develop a self-evaluation muscle that can be flexed in real-time to create greater self-awareness and productivity. Leveraging collaborative technologies like Slack, Waggl, or TinyPulse can satisfy Millennials' desires for real-time feedback.

## 6. Fixated on Flexibility

Eighty-eight percent of Millennials wish they could have greater opportunity to start and finish work at the times they choose.

Mobile technology has shifted work from a place to a space. Millennials have a boundary-less view when it comes to when, where, and how work can be done. Yet it's important to be mindful of the timing expectations or requirements of colleagues and/or customers.

**How to overcome:** Millennials who gain clarity on the outcomes they are responsible for and achieve those outcomes on a routine basis will have the necessary credibility to earn greater flexibility. Prove that those outcomes won't dip with increased flexibility by continuing to deliver efficient communication and satisfactory performance.

## 7. Lack of Experience

Twenty-five percent of Millennials have taken an unpaid job to gain experience.

Millennials are often overlooked due to lack of experience. But what value does experience hold in a culture of perpetual beta? The school of thought that experience is needed to produce high-quality work is permanently expelled in today's digital age. In a world that moves fast, fresh perspectives and skills have new value. The new world of work will reward those experienced in being inexperienced.

**How to overcome:** Millennials who want to squash the lack of experience shortcoming must demonstrate honest gratitude for the people and processes that preceded them while applying conviction and a strong work ethic behind their ideas.

## 8. Act Entitled

Sixty-one percent of American adults think of Millennials as "entitled."

There probably isn't another word more synonymous to Millennials than the word entitled. Whether or not you believe Millennials are entitled, with 61 percent of American adults believing they are...perception is reality, and Millennials should do what they can to combat the label.

Millennials who demand or expect things too fast instead of being patient and respectful only expose their naiveté as young professionals.

**How to overcome:** Give your effort, help, and support without expecting anything in return. Don't demand anything, earn everything. ■



## INTERNATIONAL NEWS

### NEBB Australia: Annual Seminar Event a Success!

NEBB Australia hosted its annual seminar on September 8 and 9, 2016, which included a site tour of the Victorian Comprehensive Cancer Centre led by Greg Morley and James Hattam. Nineteen attendees viewed the state-of-the-art facility. Details of this building including photos can be viewed at: <http://www.vcccproject.vic.gov.au/>.



Lyn Dyason, Chapter Coordinator

Other seminar highlights included:

- Record-breaking attendance of 85 people
- A new venue in Melbourne CBD for the first time
- Dinner attended by 50 CPs and CTs from around Australia and South East Asia
- Vendor displays included Belimo, Pacific HVAC, Dwyer Instruments, ASG Exical, and X-Operative
- Presentations included:
  - Capstone Microturbines: Practical application, installation and commissioning of Microturbines in the built environment by Kane Ravenscroft, Optimal optimised energy Solutions
  - Predictive Balancing Method to Balance HVAC Systems by Justin Foster, Dwyer Instruments
  - Air Diffusion Commissioning and Balancing by Andrew Krake, Holyoake Industries

“Feedback this year has been very positive,” said NEBB Australia president Chris Wright. “We had excellent presenters and quality content – there was something for everyone this year!”

### Bruce Williams Received the Bruce Giles Distinguished Service Award

The Bruce Giles Distinguished Service Award is the NEBB Australia version of the George Hightower Award. It was established to honour outstanding individuals who have served

NEBB Australia with distinction, given their time and talents and proven their dedication to NEBB and the future of this industry through their exemplary service. The 2016 recipient was Bruce Williams. The citation on Bruce’s award read as follows:

Commencing his career as an apprentice plumber, Bruce Williams commenced in the Commissioning field with AG Coombs in Melbourne. Bruce gained a Victorian Overseas Foundation (VOF) scholarship to go to work in the USA. While in the USA, Bruce worked in a commercial air conditioning firm in Atlanta, Georgia, under the guidance of George Hightower, an extremely well regarded industry person as well as a staunch NEBB supporter and board member.

During his time in the USA, Bruce was encouraged by AMCA Committee members, back in Melbourne, to undertake NEBB training and examinations and to bring back that expertise to Australia. Bruce gained NEBB Certification in Testing Adjusting and Balancing and Sound and Vibration Testing in the USA in 1980. Bruce then returned to Australia and became the inaugural Technical Committee Chair and was instrumental in the establishment of the first NEBB Chapter in Australia, Victorian EBB in 1981.

Bruce has remained an active NEBB Supervisor and Certified Professional since that time and since 1987 has conducted his own NEBB Certified mechanical services business, B.N.W. AirConditioning Pty Ltd. Bruce recently moved to work with CommTech Commissioning Technologies as their Certified Professional where he continues to mentor and pass on his expertise to others.



Chris Wright presents the Bruce Giles Award to Bruce Williams

As a permanent testimony to his long commitment to the NEBB program in Australia, it is fitting that NEBB Australia proudly bestows its 2016 Bruce Giles Distinguished Service Award on Bruce Williams.

## CHAPTER NEWS

### Mid-South EBB Chapter (MEBB): Ginger Slaick, EVP/Chapter Coordinator



Attendees of MEBB's Recertification Seminar and Annual Meeting

MEBB hosted its Recertification Seminar and Annual Meeting on October 1-2, at the beautiful Perdido Beach Resort in Orange Beach, AL. The seminar was well attended by chapter members and guests seeking required NEBB continuing education credits. This year's agenda was packed full of informative topics on industry-related technical issues, workforce development, and business skills to improve profitability. MEBB was fortunate to have speakers including Nic Bittle, author of *Small Business, BIG Mistakes*, and *Perform Like the Boss*; Brad Croasdale, Global Business Development Manager for HVAC Test Equipment with Dwyer Instruments; William (Bill) Freeman, Director of Science & Technology for AHA Consulting Engineers; Bill Kinnard, President and Owner of Grandy & Associates; Jim Huber, NEBB Past President and President of Complete Commissioning, Inc.; and our very own, Steve Wiggins, Commissioning and Operations Engineer for Newcomb & Boyd and a member of the NEBB Commissioning Committee.

Attendees also had the opportunity to visit with several vendors during our Inaugural Vendor Exhibit. Several attendees were the lucky winners of some fabulous door prizes. Thanks to Ameritech Computer Consultants, Dwyer, Evergreen Telemetry, Instruments Direct, Retrotec, and Testo, Inc. for their support of the MEBB Vendor Exhibit and their donation of door prizes.

MEBB is proud to announce the 2017 Recertification Seminar and Annual Meeting will be held September 23-24 at Marina Inn at Grande Dunes, Myrtle Beach, SC. This is one recertifica-

tion seminar and annual meeting not to be missed! Plans are already underway for excellent technical sessions, business development, and a tour of EBTRON! Plus, the Vendor Exhibit, which gives attendees the opportunity to communicate directly with the vendors, who provide hands-on demonstrations of the latest tools and technology used in businesses.

For additional information, please visit the MEBB website at [www.midsouthebb.com](http://www.midsouthebb.com), or contact MEBB's EVP/Chapter Coordinator, Ginger Slaick at 678-407-2754 or [gslaick@midsouthebb.com](mailto:gslaick@midsouthebb.com).

### Cap MarVa Chapter: Jim Kelleher, CapMarVa Board Chairman

The Capital MarVa International NEBB Recertification Seminar held at the OMNI Hotel, in Richmond VA, on September 16, 2016, was a rousing success. The opportunity to get the chapter members together is not to be wasted. In respect for everyone's busy schedules the Technical Committee strives to make the best use of the time possible – they did not disappoint. Presentations from Dwyer-M&M Controls, Ebtron, and Intertek Building Science Solutions introduced our 110 attendees to some new concepts on issues affecting our industry in measurement, verification, and analysis. Presentations included:

1. **Ebtron** – Operation and Performance of Thermal Dispersion Array
2. **M&M Controls/Dwyer** – Innovation in Flow Hood Technology
3. **Intertek Building Science Solutions** – Observation and Analysis on Building Enclosure Commissioning (BECx)

We look forward to keeping current in the industry and have many partners helping make that happen.

## NEBB ON THE ROAD

NEBB's presence at the International Facilities Management Association (IFMA) World Workplace 2016 on October 5 and 6, in San Diego, CA, was due to the commitment and enthusiasm of Marketing Committee member Allen King. King graciously made all the arrangements for the NEBB booth and faithfully staffed the area which drew a fairly steady stream of visitors.

In his report on the event, King noted that NEBB disciplines were not represented at the event's sessions and remarked that "We have a huge opportunity with IFMA to get in front of them [IFMA trade show attendees] to show the facility managers that they need the services that NEBB certified firms can provide." If you are interested in being considered as a presenter at IFMA 2017 in Houston, TX, October 18-20, please contact [communications@nebb.org](mailto:communications@nebb.org).

NEBB intends to increase its presence at industry trade shows and is currently scheduled to exhibit at the following events in 2017:

**AHR EXPO**

January 30-February 1  
Las Vegas, NV

**BOMA's Every Building Conference & Expo**

June 25-27  
Nashville, TN

**ASHE Annual Conference**

August 6-9  
Indianapolis, IN

**IFMA**

October 18-20  
Houston, TX

## Committee Reports

**MKT**

### Marketing Committee

**Eric Jenison, Chairman**

Total Dynamic Balance, Inc.

The *NEBB Professional* issue for the first quarter of 2017 has its production schedule set and 2017 advertising solicitation is underway. Cover stories for each issue are being reviewed. The magazine's mailing list has also been updated to include all Firms, CPs and CTs, plus other industry officials.

Other marketing efforts included redesigned discipline seminars brochures, completed in early August, along with a marketing schedule to advertise the seminars which included email blasts, postcards and updates to the website. Next year's goals include obtaining dates and locations for 2017 spring and fall seminars so the events can be promoted early in the year. The Marketing Committee is also working on the schedule of 2017 industry shows where NEBB will attend.

A new venture for the Marketing Committee includes the creation of a Young Professionals Network, and developing a structure for young professionals within NEBB so they can network and connect. This is a "new market" for the Market-

ing Committee and the network is a work in progress. Specifics of the program are still being developed, but the Committee has received positive feedback from young professionals who are interested in becoming involved.

**FHT**

### Fume Hood Testing Committee

**Mike Kelly, Chairman**

Air Filtration Management, Inc.

The FHT Committee has been working on finalizing the second edition of the *Procedural Standard for Fume Hood Performance Testing*. The second edition has minor changes from the first edition and will incorporate the recently released ASHRAE-110; 2016 specification. Once the Standard is approved, the committee will then work with the Exam Development Committee to develop the FHT CP Body of Knowledge in order to build a complete training seminar and new FHT CP exam.

The committee is actively searching for corresponding members to assist in reviewing the documents. Interested individuals can contact Mike Kelly at [mjkelly@airfiltrationmgmt.com](mailto:mjkelly@airfiltrationmgmt.com).

**S&V**

### Sound & Vibration Committee

**Kevin Gaghan, Chairman**

Gaghan Mechanical, Inc.

**Stuart McGregor, Member**

Engineering Dynamics, Inc.

The Committee will be pursuing the following goals:

- Beginning work on the Sound Measurement CP and CT Body of Knowledge.
- Beginning work on the Vibration Measurement CP and CT Body of Knowledge.
- Working with the Exam Development Committee, the Sound & Vibration exam is being reviewed and modified.

**TAB**

### TAB Committee

**Steve Clark, Chairman**

Working in tandem with the Exam Development Committee, under the auspices of the Certification Board, the TAB Committee approved the final changes to its TAB CP and TAB CT Bodies of Knowledge (BoK). A new curriculum will be developed by the TAB Instructors to coincide with the new BoK and the Exam Development Committee, working with their Subject Matter Experts will begin writing a new TAB CP exam. Anticipated roll-out of the new curriculum and exam is approximately early Q2 2017.



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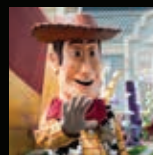
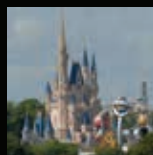
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