The Evolution of Ultrasonic Flow Meters for Liquid Applications in the HVAC Market

About 30 years ago, I made a sales call to a large Chicago HVAC contractor. My quest was to demonstrate an ultrasonic flow meter that would clamp-on to the outside of the pipe. At that time, the industry standard was to drill a hole into the pipe and insert a pitot tube flow meter (monitoring the differential pressure). A large crowd gathered as we removed the insulation off the pipe right after a 90 degree elbow. As I clamped on the transducers to the pipe the room became so quiet you could have heard a pin drop, and I distinctly remember hearing only my heart beat. Everything was now in slow motion as I pressed the on button. “Click” and it lit up like a Christmas tree with lights dancing across the display screen. After what seemed like an eternity, the display finally indicated the Gallons Per Minute. The room broke out in applause as I relished this as one of my finer moments in life.

The meter I used back then was the latest high tech 1980’s version of an Ultrasonic Doppler Technology. It required either suspended solids (>100 PPM, > 30 Microns) or turbulent flow, mounted right after a 90 degree elbow. One quirk at that time was that it had random issues with copper pipe. The Ultrasonic Doppler technology works more like
radar in that it needs something to reflect off of, in this case a suspended solid or aggressive turbulence. No solids or turbulence equaled an indication of no flow. It transmits sound waves through the pipe into the fluid with suspended solids. At no flow conditions the transmitted and reflected frequencies are the same. Under flowing conditions, the frequency of the reflected wave is different due to the “Doppler Effect.” When the fluid moves faster, the frequency shift increases and the electronics process the signal to determine flow.

Needless to say, it received mixed review from the HVAC community and was better suited for applications with large amounts suspended solids such as sewage or sludge in the waste water industry.

Although the ultrasonic transit time flow meter was also around 30 years ago, it too had a number of limitations. Fast forward to 2009 – No one puts holes into the pipe anymore. If you’re monitoring differential pressure, you’d better have some ports because the industry trend for measuring liquids is now the Ultrasonic Transit Time Flow Meter. Unlike the Doppler, the transit time technology works on clean liquids and does not require any suspended solids.

Clamp-on transit time technology uses time and distance to calculate volumetric flow (GPM).

Transit time flow meters send and receive ultrasonic waves between transducers in both the upstream and downstream directions in the pipe. Under no flow conditions, it takes the same time to travel upstream & downstream between the transducers. When there is flow, the upstream signal will travel slower and take more time than the downstream signal. Essentially, the faster the flow, the greater the difference between the upstream and downstream signals. The electronics process this signal to produce volumetric flow.

The Ultrasonic Transit Time flow meters now come in many different shapes and sizes, so for the purpose of this article I will focus on HVAC friendly features.

A key factor as to what brand or model you choose is based on how easy it is to use. This includes the actual time it takes for you to program it and install it on a pipe. The good news is that the hand held models keep getting smarter and smaller, so hanging a portable ultrasonic transit time meter on your shoulder while climbing up a ladder or scaffolding is now a much less painful experience.

Need to monitor BTU? No problem with the strap on RTD kit that ultrasonic meter becomes a energy meter. So how do you collect all this data? Easy, with the best new features on the handhelds are the built-in data loggers. It takes one button press to fire up a quick log to record all data on the screen, or drill down a few commands and you can program it for specific start and stop date and time. Data storage or number of data points is a thing of the past with the new 1 Gig SD cards. The data is stored as a CSV file and the data retrieval is as simple as removing the SD card from the handheld flow meter and installing it into your laptop or PC. If you don’t have a SD card slot on your computer, you can pick up a USB converter for a few bucks at any office store.

The other half of the equipment equation is the transducers. Unlike the ultrasonic dopplers that have one transducer for most pipe sizes, ultrasonic transducers have several different types based on pipe size and frequency. Take note, some of the less expensive brands do not offer a selection of different transducers, and only work on limited pipe sizes. For the most part, transducers come in a small pipe 4 or 2 MHz, (1/2" to 2" or 4"pipe size), medium 1 MHz (2" to 16" or 48" pipe sizes), and large 0.5 MHz (26" and up pipe sizes).

Secondly some transducer assemblies come as single units while other come as a bag of easy to lose parts. This can make a big different on your installation time. To install your transit time transducer, you will need to program the hand held or wall mounted electronics with the pipe size, (OD & Wall), material and process fluid (for a water and <50% glycol mix, use the water setting). The meter will calculate the various sound speeds and display the transducer spacing.

Remove any pipe insulation, adjust the spacing on the transducers, apply the acoustic compound, and clamp them on the pipe and you’re reading flow (GPM).

It’s that easy...well, not always. It was the last day on a project and I promised a friend that I would provide equipment and labor so he could get off the job. Schedules got messed up, and somehow I ended up on the top of a shaky ladder with a chilled water line running over my head. Of course, it was the hottest day of the year, and here I was sitting on top of a ladder with my head in what felt like a sauna trying to read the display on the flow meter as sweat rained on my safety glasses.

Rats, I really wished I had programmed the meter before I crawled up that ladder. Finally, the meter offered the precious pipe spacing dimension that I sought and needed to mount the transducer to the pipe. Fortunately, the flow meter was on a shoulder strap because I had to balance the ladder and use two hands to attack the pipe. Locking my knees together to keep the old ladder from shaking, I grabbed the pipe with one hand to steady myself. Although the manual recommends you strap on the transducer to the pipe, I was making like a monkey and was hanging from the pipe and holding the transducer to it, while simultaneously trying to look under my steamed up glasses and monitor the flow meter display.

My eyes were filled with sweat and I couldn’t make out the numbers on the display, but I did manage to locate the button for the quick log and mashed it down to save my hard earned flow data. As I crawled down my wobbly ladder, now less like a monkey and more of a tree sloth all drenched in sweat, my friend finally appeared. He smiled as he looked me over and said, “Yes sir, just another typical day in the life of a balancer.”

By Brent Baird, Instruments Direct
www.instrumentsdirect.com
NEBB Announces Procedural Standard for Building Envelope Testing

The National Environmental Balancing Bureau (NEBB) announced their newest publication: *Procedural Standards for Building Envelope Testing.*

Building Envelope Testing is NEBB’s newest discipline and addresses a distinct need within our industry; the ability to test and quantitatively report the performance of the air-tightness of today’s building enclosures. Two procedures are provided for the practitioner to follow in testing the integrity of the enclosure: A Blower Door Test Method and a Building HVAC System Test Method.

The Procedural Standard defines the requirements for certification of the firm and for certification of the individual professional. Additionally, the publication identifies the required instrumentation and equipment to properly perform the associated tests and the accuracy, range, resolution and calibration requirements of the instruments and equipment. Reporting requirements are also identified.

For more information on purchasing this manual, please visit www.nebb.org.

---

NEBB Releases Commissioning of Commercial Refrigeration Systems Guideline

NEBB announced their latest publication *Commissioning of Commercial Refrigeration Systems Guideline* which was developed in collaboration with RSES.

NEBB’s *Commissioning of Commercial Refrigeration Systems Guideline* establishes a uniform and systematic set of criteria for the performance of the Commissioning process when applied to refrigeration systems.

This guideline establishes the technical process of commissioning a refrigeration system and is intended to be used as an extension of NEBB’s *Procedural Standard for Whole Building Systems Commissioning of New Construction.*

---

Energy Efficient Valves for Green Designs –
Electronic Pressure Independent Valve (ePIV)

- Precise flow control eliminates over pumping and provides favorable energy savings.
- Prevent energizing additional chillers by maintaining desirable Delta T.
- Performs continual balancing to maintain performance.
- Constant flow regardless of pressure variations.
- Ability to change from equal percentage to linear flow characteristics with software modification.

> Learn more at www.piccv.com
Greetings and thank you for the opportunity to represent you as the new local Chapter President.

A lot of changes have taken place in our local Chapter since I joined the Board of Directors many years ago as the Technical Committee Chairperson. It began with a goal of complete compliance by our membership to NEBB standards regarding instrumentation qualifications. This was definitely a challenging task but one that has ultimately proved to be successful. We also brought true meaning to the Quality Assurance Program (QAP) and took on the task of holding our membership accountable for the quality of their workmanship. We next moved into report content with Steve Smith taking the helm as Technical Chairperson to work with compliance to NEBB standards by our Firms and that also has been successful along with continuing on instrument qualifications.

As I moved on to Vice President/Treasurer it was time for another challenge to spread our wings and move our local Chapter to a new office location and establish our own administration of it. This required an extended stay at the Vice President/Treasurer position as I wanted to make sure that accounting and information technology was established so the next person to occupy this position would have a smoother transition. After two years on our own I can say we have met that goal also.

Now it is time again to move on to a new challenge as your President. In April 2012 I will be attending the NEBB National Meeting representing our Chapter and I’m looking forward to see what NEBB National’s vision is for the future.

My goal in this term of office is to see that we continue to meet and or exceed NEBB standards with our membership. There are some members that will leave our Chapter and also new ones that will be joining us. It is important that we continue to impress upon not only our current members but our new ones that meeting NEBB standards is a must.

We also need our membership to be actively involved in our local Chapter, this can be accomplished as committee members, proctors etc. Most of these activities can be accomplished over the phone or via electronic transmissions. There is only one paid staff which is our Chapter Coordinator Audrey Kearns, the rest of us are volunteers. In order for this Chapter to remain strong and grow it relies on you volunteering your time and efforts. It is a lot more work than one person can possibly perform. To those of you who currently volunteer I thank you for your service. To the rest of you I look forward to your participation and thank you in advance.

Sincerely,

Curtis Worley, President
HVAC Air Leakage Testing
Duct Leakage Testing

ORIFLOW
HVAC AIR LEAKAGE TEST EQUIPMENT

Simple Gauges
Calibrated Orifice Plate
Tech Support 7 days/week
Model C1 Air Leakage Tester Shown
Customer Support 7 days/week
Calibration Certificate
12-ft Heavy Duty Flex Duct

Technical Support from a Professional Engineer 7 days/week

20 years of expertise
(323) 230-7589 sales@oriflow.com
www.oriflow.com
ACCO Engineered Systems is the largest Design/Build mechanical engineering firm in the Western United States, and is entirely employee-owned. It specializes in heating, ventilation, air conditioning, refrigeration, plumbing, process piping, building automation, electrical contracting and building services. ACCO has on average over 1,700 employees located throughout the Western United States, with 280 employees located in its San Leandro office.

ACCO Engineered Systems was founded in 1934 as Air Conditioning Company (ACCO), located in Los Angeles. This former name was chosen because so few people knew what air conditioning was at the time. In 1949, the firm moved to Glendale, its current corporate address. In 2002, ACCO changed its name to ACCO Engineered Systems to better reflect the many aspects of its business.

Currently ACCO has two NEBB Certified Professionals on staff, Amber Ryman and Jack Holke and one NEBB Certified Technician, Mike de los Reyes.

Amber has been with ACCO for a little over 11 years. She started in the Start, Test and Balance group at ACCO as an apprentice with the Pipefitters Union. Prior to joining ACCO, Amber had no experience in the trades. She worked for a small firm in its office helping the project managers and estimators, and had no knowledge of what she was looking at. She decided that if she wanted to pursue this field she would need field experience, so she went to the pipefitters union hall and signed up for the apprenticeship program. In her second year of the apprenticeship program she went to work for ACCO, and was able to complete her 5-year apprenticeship program while she learned the ropes of the Start, Test and Balance Department. Once she became a journeyman, she was running projects and seeing jobs through to the end of the project, her responsibilities grew and she was approached to take the NEBB Certified Professional exam. Since she passed the NEBB test in 2010 and received her NEBB Certification in Air & Hydronics Balancing, she has taken on the opportunity of supervising the TAB portion of the department. She has five technicians reporting to her, and is looking at bringing on one more. Currently, Amber holds her Air and Hydronics Balancing NEBB certification, and is in the process of completing the Building Systems Commissioning and Retro Commissioning certification. Once that is accomplished, she will be the only commissioner in Northern California for ACCO.

Jack Holke has been a Project Manager with ACCO’s service group since 2005 and has been a NEBB Certified Professional since 1996. At Cal Poly San Luis Obispo, Jack’s career plans were to get his political science degree and then attend Law School. Tiring of school, Jack’s fraternity brother convinced him to interview with an air balancing firm that his father was associated with. One week after graduation, Jack started his career as a TAB Technician in 1984 for NABCO. One month after starting work at NABCO, Jack attended the Sheet Metal Union apprenticeship program for 3 years. After 16 years as a TAB Technician where he worked for several different firms, he made a career change. In 2000 he went to work for ACCO as a Project Engineer and then in 2005 he took on his current role as Project Manager. Although AC-
CO is a Design/Build firm that tests and balances its own jobs, Jack is starting to bid more plan and spec work. Jack’s NEBB Certification is for Air & Hydronics Balancing, and even though he is not specifically using his certification in his present position he maintains his certification for future possibilities. He finds that his NEBB certification helps him to generate more work for ACCO. He is proud of his NEBB certification and feels that the NEBB certification sets a person a notch above, letting everyone know that he has attained a certain level of knowledge and experience.

“Our NEBB Certification has been beneficial because it gives our customers the sense of security knowing the strict procedural standards are being met and that they can count on the quality of work being performed. When they ask us what our qualifications are and we respond that we are NEBB certified, there seems to be an end to the questions and usually an approval of the project. Our customers understand the importance and value of our NEBB certification.”

ACCO has worked on many projects, and with countless companies and institutions over the years such as Google, Adobe, Pixar, Cisco, Netflix, Stanford, Apple, Facebook, Genentech and Yahoo, to name a few.

ACCO Engineered Projects

LLNLab Bldg 490 Chiller Replacement - Phase 1 - complete, Phase 2, Chiller 2 - ongoing

New photo capture feature!

Remember what issues and equipment look like with photos.

Capture photos in the field with your iPad or Android device and synchronize the photos back to your main project log.

We support Apple iPad™ and netbooks, laptops or tablets running Windows. Android Support now available!
Marketing  Northern California/Hawaii

We are looking forward to a great year of marketing for NEBB NorCal/Hawaii. NEBB National has a new Marketing Director, Mandy Kaur. I met her at the National Annual Meeting in Savannah Georgia. We are looking forward to working with her and helping her to understand the areas of our concerns.

Also, we gave out a “NEBB NorCal Marketing Questionnaire”, to gain a better idea of the membership’s areas of work and interest, so we can better target our marketing efforts for 2012.

If you are interested in helping, we are looking for marketing committee members. The time commitment of the committee members will involve a couple of meetings and if interested, attend some of the marketing events that we will be planning. So, if you are interested in assisting us in planning our marketing effort for the 2012 year, please let Audrey know.

Looking forward to a great 2012!

Bill W. Jeffrey, Marketing Chair
2012 NEBB ANNUAL CONFERENCE
APRIL 26-28
ANAHEIM, CALIFORNIA

“Building a Bridge to the Future”

For registration information go to:
www.nebb.org

Follow us on Facebook at
Northern California/Hawaii NEBB
COMMITTEES:

TECHNICAL:
Jason Huffman, Pacific Test & Balance, Chair
Greg Bluhm, CSI, Inc.
Jim Taylor, TK & Assoc.
Carey Tomasa, Air Balance Hawaii
Steve Smith, Pacific Test & Balance, Inc.

EDUCATION:
Vic Congi, Carter Air Balance, Chair
Bill Jeffrey, DPR Construction
Ryan Chang, TAB Engineers
Martin Burke, TSS, Inc.
Vic Congi, Carter Air Balance

MARKETING:
Bill Jeffrey, DPR Construction, Chair
Romy Gonzalez, Alpha Air Balancing
Dan Moore, Pyramid Balancing
Sargon Ishaya, Pragmatic Eng.
Greg Bluhm, CSI, Inc.

On Demand Basis
Contact the Chapter to sign up, akearns@nocalhawaiinebb.org

NEBB Certified Professional Written/Practical Exam
March 17, 2012, 8:00 a.m.—1:00 p.m., San Leandro, CA
Contact the Chapter to sign up, akearns@nocalhawaiinebb.org

NEBB National Annual Meeting
April 26-28, 2012, Anaheim, California
Conference Registration Open December 15, 2011
Contact NEBB National

NEBB Technician Exam
On Demand Basis
Contact the Chapter to sign up, akearns@nocalhawaiinebb.org

Northern California/Hawaii NEBB
39899 Balentine Drive
Suite 200
Newark, CA 94560
Phone: 510-386-1270
Fax: 510-438-6853
E-mail: akearns@nocalhawaiinebb.org