Part 2—EBTRON Permanent Instruments Satisfy NEBB Procedural Standards for TAB Airside Activities

By Len Damiano, EBTRON, Inc.

6.1 INTRODUCTION

The purpose of this Section is to describe the procedures used in making basic TAB measurements.

These recommended procedures are to be followed for all TAB measurements so that the reported data is accurate and repeatable. ...

The ability to take accurate and repeatable measurements may depend on the skill of the technicians and measurement locations. The NEBB Certified TAB Firm is responsible to determine the appropriate location for all air and hydronic test
measurements at terminals, equipment, ducts, and piping.

For air systems, it is necessary for the NEBB Certified TAB Firm to drill test holes for the purpose of taking measurements in ducts or equipment. These test holes shall be appropriately sized and sealed with the appropriate industry standard plugs when the measurements have been completed.

The stated primary objective of the procedures is used to introduce this section. This purpose is consistent with the NEBB Certified TAB Firm employing the most accurate and reliable tools at their disposal. The section warns that taking measurement by hand does not give valid results automatically. Knowledge, preparation and care are necessary for good results, which are mostly needed to compensate for the characteristics and limitations of the measurement technologies or method used.

This section assumes that a Pitot traverse will be used, requiring test holes. Permanently installed devices do not require test holes and the additional leakage potential that they represent. If superior instruments are judged in good working order, installed per the manufacturers instruction, and of the type the TAB technician knows will provide reliable values; then, they should be used – especially when the conditions are impossible for a Pitot probe, but acceptable for an EBTRON sensor array?

6.3 AIR VELOCITY PROCEDURES

The following procedures describe the methods to be used when making air velocity measurements.

While the procedures outlined here are prescriptive, instrumentation use should always be in accordance with the manufacturer’s recommendation. All instrumentation used for air velocity measurements shall conform to the requirements of Table 4-1 for function, range, accuracy, and resolution.

Our comparative analysis earlier demonstrated the published performance accuracy of EBTRON Gold Series probes and the requirements stated in Table 4-1. We can summarize the conclusions below:

EBTRON published performance dramatically exceed the requirements of Table 4-1 (2005) & 5-1 (2012) in all but one item – temperature measurement range extremes:

TAB temperature measurements of process variables might require extreme range capability at unusual locations. However, in those areas carrying conditioned or outdoor air that would typically be contained in ducts, it would be very unusual for temperatures to exceed the tested and calibrated environmental range for EBTRON sensors (-20 to +160 oF). We would argue that their operating temperature range is acceptable for the locations where EBTRON would normally be found and in use; especially when coupled with the significant performance advantages in accuracy, resolution and stability.
The EBTRON models indicated and most EBTRON products are UL Listed (file nos. XAPX.E230254 and XAPX7.E230254 for US and Canada), based on Standard UL873 for Temperature (and Airflow)-Indicating and -Regulating Equipment. EBTRON subscribes to the UL follow-up services as well. These products are also tested to the latest EMC Directives and approved to carry the CE Mark for Europe.

6.3.1 INSTRUMENTS

The following instruments are typically utilized to perform air velocity measurements:

- Electronic-Digital Manometer
- Inclined-Vertical Manometer
- Maneghelic Gauge
- Pitot Tubes
- Airfoil Probes
- Rotating Vane anemometer
- Swinging Vane anemometer
- Bridled Vane anemometer
- Thermal Anemometer (Hot Wire)
- Velocity Grid

EBTRON products can generically be considered a “thermal anemometer”. However, the term does not convey the substantial differences there are between the technologies included in this long family of products. Single point thermal anemometers are predominantly analog electronic sensors, which may have a processor running the display, data logging and calculations. They are extremely sensitive to position (therefore insuring technician inconsistency) and to turbulence. Both are issues that the EBTRON design has greatly overcome. The only thing we can say is common between the products is the basic “thermal” nature in their designs. But, the operating theory and principles are substantially different. The number of thermal devices available may reflect an equal number of different theories of operation and no two can be truly equated.

6.3.2 GENERAL MEASUREMENT TECHNIQUES

Duct air velocity measurements typically are performed to determine air volume in a duct by Pitot tube traverses. The Pitot tube traverse, properly conducted, is the basis for all other airflow measurements performed by a NEBB Certified TAB Firm. Other instruments used for air velocity measurements are rotating vane anemometers, swinging vane anemometers, thermal anemometers, velocity grids, etc. These devices are typically used for measurements where flow hoods are not appropriate, or where the air velocities are too low for accurate measurement by a Pitot tube traverse. In all cases the instrument manufacturer’s application recommendations shall be followed.
6.3.3 SPECIFIC MEASUREMENT TECHNIQUES

h) The accuracy of a Pitot tube traverse is determined by the availability of a suitable location to perform the traverse. Suitability of the location is determined by the quality of the data measured. ... It is important to note that the acceptability of the traverse plane is determined solely by the quality of the data, and not necessarily by the location of the traverse plane.

The Pitot measurement principle is subject to factors that do not impact EBTRON technology to the same degree or not at all.

Measurement by Pitot traverse is a time-consuming process. An almost instantaneous traverse on a fixed perpendicular plane to airflow direction, performed with automated precision can improve both the results of the system balance and allow the TAB firm to speed completion of a project while reducing labor costs or manpower required.

6.4 TEMPERATURE MEASUREMENT PROCEDURES

6.4.1 INSTRUMENTS

The following instruments are typically utilized to perform temperature measurements:
- Liquid-in-glass thermometer
- Dial thermometer with a bi-metal helix coil
- Thermocouples
- Electric resistance thermometers including thermistors
- Psychrometers
- Electro Thermohygrometers

6.4.2 GENERAL MEASUREMENT TECHNIQUES

The purpose of most temperature measurements in TAB work is in connection with determination of heat flow, or in determining a heat balance. A heat balance calculation from measured data will never be perfect for a variety of reasons:
- Lack of a uniform temperature / velocity profile.
- Instrumentation accuracy, precision, and sensitivity.

Each of these issues needs to be understood prior to taking field measurements.

Steady state: Most heat transfer processes in TAB work never achieve thermodynamic equilibrium or steady-state conditions. When steady state conditions do not exist, a sufficient number of temperature readings must be taken during a given time rate and the results integrated over that time.

Same instrumentation: The final issue deals with the use a single instrument. Differential temperature measurements shall be taken with the same instrument. The use of a single instrument negates errors in accuracy and precision.

EBTRON uses a bio-medical grade, “bead-in-glass” type thermistor for both ambient temperature measurement and to determine the relative heat (power) lost due to air movement. This is a very specific type of thermistor and excludes all other types that use glass in their manufacture. They were selected for their accuracy potential, stability and long-term reliability. The part used by EBTRON is also sold with NIST traceable calibration for accuracies as high as 0.01°C.

Should one sensor become damaged, the electronics notifies the control system or user and continues to function while ignoring the suspect sensor and averaging the balance to output.
EBTRON’s thermistors are unlike those used in thermostats and used by other thermal velocity stations. Other thermistors are typically mass produced for consistency in temperature measurement. They are not designed to be repeatedly heated and cooled for velocity measurement. Mechanically fastened leads have a tendency to fail from this type of stress. The epoxy or diode case used is too massive to allow rapid and efficient heat transfer. This produces a significant lag in responsiveness, not to mention questionable measurement accuracy.

6.4.3 SPECIFIC MEASUREMENT TECHNIQUES

Air Temperatures – Dry Bulb

... Where a non-uniform profile exists, an exact temperature traverse and a corresponding velocity traverse shall be made and the weighted average used as the resultant temperature. A weighted average means that the traverse would be weighted for the amount of air flowing, or velocity, in each of the equal area traverse grids.

Velocity-weighted temperature averaging is a user selectable output option on EBTRON GTx116 and HTx104 transmitters and is a standard feature on every unit in these two model groups.

8.3 ESTABLISHING FAN TOTAL AIRFLOW

8.3.1 The most accurate and accepted field test of airflow is a Pitot tube traverse of the duct. Procedures for conducting a Pitot tube traverse are found in Section 6. In situations where a Pitot tube traverses is not available, the system airflow may be determined by alternate methods, such as anemometer or velocity grid traverses across coils and / or filters, or the summation of air outlet measurements. These alternative methods are subject to a greater degree of error than Pitot tube traverses and should be used with caution.

8.3.2 Additionally, if a Pitot tube traverse is available, a comparison of the total outlet airflow measurement with the Pitot tube traverse readings of the fan total airflow may assist in quantifying possible duct leakage. It is important to note that differences between total air outlet volume and Pitot tube traverse totals may be indicative of duct leakage, measurement errors, or incorrect area factors. Accurate assessment of duct leakage requires a specific duct leakage test, which is outside the scope of TAB work.

The Procedural Standards assume that the Pitot-static tube duct traverse measurement is the most accurate method of field measurement available. This conclusion requires qualification. Although well established, accepted and dependable, it has significant application limitations in measurements when used in less-than-adequate conditions. It is apparent with the level of uncertainty that accompanies these types of measurement that the analysis would not compare favorably to other methods or devices or even another traverse in another location or separated in time. Therefore, in some circumstances undefined by the Procedures, there are other technologies or methods that are superior in measurement performance, making the conclusion inaccurate. This is self-evident in the statements that follow, indicating that the Pitot traverse in not always suitable and that measurement error might not allow its use to diagnose duct leakage.

Depending on the inherent accuracy and design of the instrument being used, measurements downstream of coils or filters can be the MOST accurate location available, depending on the capabilities of the technology used. The conclusions in these sections assume the limitations of a velocity pressure measurement apply to everything and do not consider other technologies or methods that are available.

The article will conclude with Part 3 in the next quarterly newsletter.
In today’s market it is important to be competitive and at the same time sustain the excellence we as NEBB Firms strive for. Our clients know the quality we provide and continue to demand that same quality by engaging our services throughout all of Northern California, Northern Nevada and Hawaii. Our clients are our best resource for marketing our capabilities and ability in delivering high performance buildings and systems. The quality of work we, as NEBB Certified Firms allows us to be proud of the products and services we provide our clients.

Are there any jobs you are proud of and would like to share how you were able to assist your client in delivering a high performance building? Please share with us your success stories of making buildings more sustainable. Take it a step further and use your success stories as a way to market your own firm by reaching outside to the Local and National Press. NEBB is willing to assist by editing a rough draft for press release/articles. This is an incredible opportunity to benefit your own firm and at the same time support the marketing of NEBB.

How else would you like to see NEBB advertised? Do you have any ideas you would like to share on the marketing and advertising of NEBB. I welcome all suggestions as the new Marketing Chair and would love to hear your ideas. Feel free to email me your thoughts and I will take them into consideration as I look for new and exciting ways to support the marketing of NEBB.

Amber Ryman, Marketing Chair
ACCO Engineered Systems
CSI, Inc. is an ISO-9001 registered/NEBB Certified company which was started in 2005 and NEBB certified in 2006. The co-founders and owners of CSI, Inc., John Joseph and Greg Bluhm, met while working at MESA3, Inc. With over 25 years of combined experience in Cleanroom Design and Performance Testing, they made the decision to start their own firm that would focus solely on cleanroom & controlled environmental testing. Their growth has been slow but steady, growing through word of mouth based on their excellent reputation, knowledge, and services.

Eighty percent (80%) of their projects are located in the Bay Area with sixty percent (60%) of their jobs coming from repeat customers. CSI, Inc. specializes in cleanroom services and investigation for the microelectronic, bio/pharmaceutical, and other high tech industries. Currently they have 6 employees; two NEBB Certified Professionals in Cleanroom Performance Testing, 3 field technicians, and one office staff. President of CSI, Inc., John Josephs’ areas of responsibility are performance testing and data acquisition, project management, field technician supervision, training for testing services, and customer relations. Vice-President Greg Bluhm; provides technical/QA training, oversees the Quality Assurance program implementation and management, and analysis report design, creation, and quality review.

Within this industry, the FDA is becoming stricter and the customers are becoming more knowledgeable about the requirements. As a result customers demand greater attention to detail and quality. CSI, Inc. continuously updates their SOP’s so as to comply with the most current International and Federal standards, such as cGMP, ISO, IEST, ANSI, NSF, ASHRAE, CFR, and Cal-OSHA. CSI, Inc. understands that reliable certification and testing data depends on accurate test equipment, therefore; their SOP’s require that all of their test equipment is kept in calibration, traceable to NIST standards, and follows the strict requirements of ANSI/NCSL Z540-1-1994 and IEST-RP-CC-013-86.

CSI, Inc.’s standard testing procedures are based on ANSI, IEST, ISO, NEBB, and NSF Standards and they use a Quality Management System (QMS) that complies with:

10 CFR 50 Appendix-B
ANSI/N45.2, ANSI/NCSL Z540-1-1994, MIL-STD 45662A
ANSI/ASQ Q9001, BS EN ISO 9001, ISO 9001, EN ISO 9001
John Joseph, President of CSI, Inc. started his cleanroom performance testing career in this industry while earning his degree in Administration of Justice. In 1994, with a second baby on the way with his wife Cassandra, while attending college and holding down a part-time job at Fed Ex, John went to work at MESA3 on a part time basis to earn some extra income. John came to a juncture in his career path where he needed to make a decision if he was going into management with Fed Ex or stay with MESA3. John decided to stay with MESA3 and worked there for 10 years until his decision to branch out and start up his own firm. John is a NEBB Cleanroom Performance Testing Certified Professional, a member of IEST since 1997 and a member of ISPE since 1998.

Greg Bluhm, Vice President of CSI, Inc., received his BA in anthropology from the University of Minnesota in 1993. After college, he worked for an injection molding facility that had a number of Class-10,000 cleanrooms. This afforded him the opportunity to become familiar with many aspects of Quality Management and cleanroom design, construction, and operation. In 1997, Greg made the decision to leave Minnesota and start a new career in California where he went to work for MESA3. His experience with Quality Management and cleanrooms at the Minnesota facility helped him at MESA3. Greg was the office manager/Vice-president for 8 years but eventually focused more of his efforts on accounting and cleanroom certification. Greg is a NEBB Cleanroom Performance Testing Certified Professional, NSF Accredited BSC Field Certifier, a member of IEST since 1997 and a member of ISPE since 1998.

CSI, Inc. feels that the industry is slowly becoming more educated on the certifications. They promote NEBB and work with their clients to have them require NEBB certification. In the last 5 years, CSI, Inc. believes that more people are becoming interested in industry standards so are more interested when they talk about NEBB to them.
Starting August 1, 2013 the Northern California/Hawaii Chapter will have available, voluntary on-line continuing education training for all our NEBB Certified Technicians. Currently technicians are recertified every 2 years at the same time that the firm and Certified Professionals are recertified. Technicians will need to accrue 6 hours of training each year to obtain a certificate for this voluntary continuing education program. If you choose not to participate then technicians will still receive recertification status under NEBB guidelines but no continuing education certificate will be issued in addition to the Certification Certificate issued by NEBB.

**NEBB Certified Technicians can accrue their 6 hours of training in the following ways:**

- Sign up through the Chapter for on-line training. The cost for this is $100.00. The NEBB Certified Technician will need to have read and studied the TAB Manual for Technicians, which can be purchased through NEBB to complete the on-line training and test. The on-line training is a randomized test covering the information in the manual. It is expected that the technician will have spent time before taking the test reviewing the manual as they will have only 6 hours to complete the on-line test. The 6 hours of training per year is expected to be made up of time spent on the test and time spent reviewing the manual. The technician will have 30 days to complete this Open Book test. Registration for the test is attached, or;

- They can attend the Chapter Annual Meeting, or;

- They can attend the NEBB Annual Meeting, or

- They can attend any NEBB sponsored educational seminar.

We intend to rotate between online training and hands-on training every other year. The Chapter has made the decision to offer this training for our NEBB Certified Technicians as part of their recertification options, in part, to further the knowledge and training of our technicians as well as meet the increasing demand from specifying engineers for up-to-date knowledge and understanding of the latest technologies used and their application in the TAB process.

Your input as the certified CP from your firm is needed to develop the training curriculum. We want to know the challenges your technicians are facing in the field regarding new devices and how to implement testing and balancing for them. For example, a couple of years ago VFD power exhaust systems started showing up on projects and additional training for our technicians was needed. The local Chapter addressed this need by facilitating factory training onsite. These are the type of items we want to hear about from our CP’s.

As this is a new feature (and an excellent marketing point) for our Chapter and your firm, we ask that you be patient during the first couple of years as we roll out this large undertaking. We know there will be challenges to working out the logistics. Please note that this program is not being funded from Chapter dues but is self-funded by those who participate. Any constructive input and time volunteered by you would further the advancement of this program. Thank you.
TAB TECHNICIAN CONTINUING EDUCATION
Registration Form

Please complete the registration form and return to the Chapter along with your fee. Once the registration form and fee have been received you will be contacted by the NEBB Chapter with your access code to start your training program. You will have 30 days to complete your training program starting with your first log-on.

Test Fee: $100
Make check out to NEBB and mail to:
39899 Balentine Drive, Suite 200
Newark, CA 94560

PLEASE EMAIL THIS FORM BACK TO: akearns@nocalhawaiinebb.org

NAME: ________________________________________________

FIRM: ________________________________________________

EMAIL: _______________________________________________

SUPERVISOR NAME: ____________________________________

SUPERVISOR’S EMAIL: ___________________________________

Technician Signature ___________________________ Date __________

Supervisor’s Signature ___________________________ Date __________
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