THE LONG ISLAND SOUNDER

October 2008

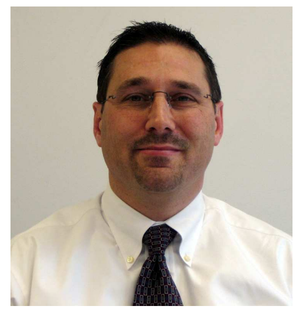
ASHRAE Long Island Chapter, Region 1...*Founded in 1957*

www.ashraeli.org

American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

Inside this issue:

President's Message



It was a pleasure to see everyone again at our September meeting. I am happy to be apart of this great group of continuous supporters and even more importantly to see many new faces. September, we were very well attended with near 40 participants at the meeting. Although the HVAC industry is rather large, most of the new faces at the meeting were those past colleagues and other familiar industry professionals. It was nice to catch up and speak with everyone at our cocktail hour, hearing about people's summer vacations, latest professional achievements and just having a few laughs. I am also proud to write that we had six Long Island chapter past presidents at the meeting and thank them for their continued support: 1994 Mr. Jerald Griliches, 1997 Mr. Norm Maxwell, 1998 Mr. Alan Georke, 2001 Mr. Ray Schmitt, 2006 Mr. John Nally and recent past president 2007 Mr. Peter Gerazounis.

September's lecture, given by controls specialist, Mr. Ron Padilla was very informative and well received. We thank Ron for enlightening all of us on the latest technologies and open protocols of Energy Management Systems. October's lecture will also be very informative, focusing upon condensing boiler design. As you are aware, these types of boilers can be highly efficient when the design and application is proper. High efficiency equipment is critical these days as the cost of energy sources continue to skyrocket so plan on attending this month's meeting. This lecture will also offer one continuing education credit. Also for the month of October, we are focusing on Student Activities and their involvement in Ashrae. I would ask all of you who sponsor and employ students, who are college professors or high school teachers to please join us at our meeting and bring as many students with you whom you feel would be interested in a career in mechanical engineering, mechanical contracting in the construction industry or related fields. We will also be joined this month by Ashrae Region One Student Activities Vice Chair (RVC), Mr. Richard Vehlow, who will update and speak to us on the importance of student involvement within Ashrae.

I look forward to seeing you again at our meeting on the 14th. For those of you who were unable to attend last months meeting, please mark your calendar for this one and all subsequent meetings. Our programs for this year are educational, diverse and most interesting.

Thank you again for your continued support of the Long Island Chapter of Ashrae.

Steven Friedman, HFDP
President - Long Island Chapter

CHAPTER MONTHLY MEETING

DATE:	**Tuesday, October 14, 2008**
TIME:	6:00 PM - Cocktails/Dinner 7:00 PM - Dinner Presentation 8:45 PM - Conclusion
LOCATION:	Westbury Manor South Side of Jericho Tpke. 25 Westbury, NY 11590
FEES: Members - Guest - Student -	 $35.00 $40.00 $15.00

Reservations requested, but not required.
Call (516) 333-7117

Long Island Chapter Officers & Committees

ASHRAE 2008/2009 OFFICERS

POSITION	NAME	PHONE	FAX	EMAIL
President	**Steven Friedman, HFDP**	212.695.1000	212.695.1299	sfriedman@lilker.com
President-Elect	**Steven Giammona, P.E.**	516.827.4900	516.827.4920	srg@cameronengineering.com
Vice President	**Nancy Román**	516.256.4800	516.256.3299	nroman@airdist.com
Financial Secretary	**Carolyn Arote**	516.256.4800	516.256.3299	carote@airdist.com
Treasurer	**Brian Simkins**	203.261.8100	203.261.1981	bsimkins@accuspecinc.com
Secretary	**Andrew Manos, LEED AP**	631.592.2660	631.630.8883	andym22@optonline.net
Board of Governors	**Janeth Costa**	631.242.8787	631.242.7084	jcosta@apollohvac.com
Board of Governors	**Peter Gerazounis, P.E. LEED AP**	212.643.9055	212.643.0503	peter.gerazounis@mgepc.net

ASHRAE 2008/2009 COMMITTEES

COMMITTEE	NAME	PHONE	FAX	EMAIL
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Chapter Technology Transfer (CTTC)	**Andrew Manos, LEED AP**	631.592.2660	631.630.8883	andym22@optonline.net
Newsletter Editor	**Liset Peña**	212.643.9055	212.643.0503	liset.pena@mgepc.net
Resource Promotion	**Janeth Costa** **Andrew Braum, P.E.**	631.242.8787 516.785.9000	631.242.7084	jcosta@apollohvac.com asb@frigidyne.com
Historian	**John Nally**	631.331.0215	631.928.4625	jn@atiofny.com
Student Activities	**Brian Simkins** **Carolyn Cammalleri**	203.261.8100 631.549.1000	203.261.1981	bsimkins@accuspecinc.com ccammalleri@lilker.com
Webmaster	**Nancy Román**	516.256.4800	516.256.3299	nroman@airdist.com
Nominating	**Michael Gerazounis, P.E.**	212.643.9055	212.643.0503	michael.gerazounis@mgepc.net
Reception & Attendance	**Robert Fuchs**	718.599.1336		rfuchs@alnikmechanical.com
PR & Engineering Joint Council of LI	**Peter Gerazounis, P.E. LEED AP**	212.643.9055	212.643.0503	peter.gerazounis@mgepc.net
Golf Outing	**Peter Gerazounis, P.E., LEED AP** **Steven Friedman, HFDP**	212.643.9055 212.695.1000	212.643.0503 212.695.1299	peter.gerazounis@mgepc.net sfriedman@lilker.com

Chapter Monthly Meeting - Program for 2008/2009

September 9, 2008 * At Westbury Manor - **1 PDH** Dinner Presentation - DDC Controls **MEMBERSHIP PROMOTION NIGHT**	**February 2009** **NATIONAL ENGINEERS WEEK DINNER**
October 14, 2008 * *At Westbury Manor* - **1 PDH** Dinner Presentation - Condensing Boiler Design **STUDENT ACTIVITIES NIGHT**	**March 10, 2009** * *At Westbury Manor* - **1 PDH** Dinner Presentation - Dedicated Outdoor Air Systems/ Energy Recovery **RESOURCE PROMOTION NIGHT**
November 18, 2008 * *At Westbury Manor* Dinner Presentation - Design/Build of LEED Projects **ASHRAE DISTINGUISHED LECTURER** **DR. TOM LAWRENCE, PH.D., P.E., LEED-AP** **RESOURCE PROMOTION**	**April 14, 2009** **FIELD TRIP - Blue Point Brewery**
December 16, 2008 Holiday Party - Westbury Manor	**May 4, 2009** * *Cherry Valley Club, Garden City, NY* **ANNUAL GOLF OUTING**
January 13, 2009 * *At Westbury Manor* - **1 PDH** Dinner Presentation - Mission Critical HVAC & Electrical Design **MEMBERSHIP PROMOTION NIGHT**	**May 12, 2009** Dinner Presentation - TBD **REFRIGERATION NIGHT**
January 24-28, 2009 ASHRAE Winter Meeting - Chicago, IL	**June 9, 2009** * *At Westbury Manor* **PAST PRESIDENTS & OFFICER INSTALLATION**
February 10, 2009 * *At Westbury Manor* **JOINT MEETING WITH SMACNA** Dinner Presentation - TBD **ASHRAE DISTINGUISHED LECTURER** **E. MITCHELL SWANN, P.E., LEED AP** **STUDENT ACTIVITIES NIGHT**	**June 2009 - TBD** ASHRAE Annual Meeting
August 2009 - Chapter Regional Conference Region I	

PAOE POINTS FOR 2008/2009

Chapter Members	Membership Promotion	Student Activities	Research Promotion	History	Chapter Operations	CTTC	Chapter PAOE Totals
297	100	0	0	200	10	200	510

October Program

You are cordially invited to our October 2008 Meeting…

Dinner Presentation

"Hot Water Boiler Systems –
What Makes Condensing Boilers Different"

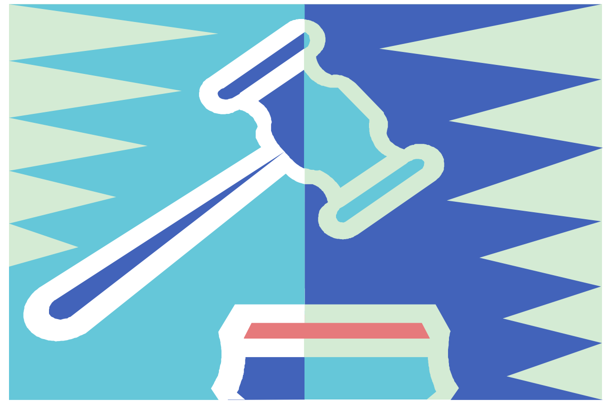
Presented by

Will Hayes
Vice President of Sales
Miller Proctor Nickolas

Attendees Will Earn 1 PDH!

DATE:	**TUESDAY, OCTOBER 14, 2008**		
Time:	6:00 PM – Cocktails and Hors D'ouevres 7:00 PM – Dinner Presentation 8:45 PM – Conclusion	**Fee:**	$ 35.00 Member $ 40.00 Guest $ 15.00 Student
Location:	**WESTBURY MANOR** (516) 333-7117 Jericho Tpke (South Side), 3/10 of mile east from Glen Cove Rd., Nassau County, NY. **Directions are posted at @ www.ashraeli.org.**		
Presentation:	This month's presentation will review how condensing boilers recover energy through available heat of vaporization and cooler return water temperatures. There will be a review of piping and control considerations for hot water boiler systems including primary-secondary piping vs. a single hydronic loop. In addition the importance of matching the control system to the boilers and the system piping will be discussed. **This seminar will earn professional engineers 1 PDH.**		
About our Speaker:	**Will Hayes** – Entered the boiler industry as an instrument technician for Houston Lighting and Power in 1968 and never left the industry. He has worked as a Control Systems Sales Engineer for Fireye, Field Service engineer and Instrument and Control systems design engineer for Reliance Instrument Company, Vice President of Engineering and District Sales Manager for Preferred Utilities is currently working as the Vice President of Sales for Miller Proctor Nickolas. Mr. Hayes received his BA from Rice University, his BSEE from the University of Houston and MBA from the University of Connecticut. Mr. Hayes has served on the Boiler Sub-Committee of the New York City Mechanical Code Committee during the adoption of the International Mechanical Code.		

Board of Governors Meeting Minutes



A meeting of the Board of Governors was held on Tuesday Sept. 9th, 2008 at the Westbury Manor. Present at the meeting were Steven Friedman, Steven Giammona, John Nally, Peter Gerazounis, Nancy Roman, Carolyn Arote, Brian Simkins, Janeth Costa and Andrew Manos. President Steven Friedman called the meeting into session at 5:04:

General Discussion- Each member gave a quick review of their time at the CRC in Mystic, CT, and what is expected from each one of them by their RVC.

Programs- Steven Giammona discussed that the speakers for the meetings have been booked and that we'll be having Distinguished Lecturers for November and February meetings. It was also discussed that we should have a one time mailer sent to all our members of the upcoming meetings for this year.

Resource Promotion- Janeth Costa discussed our new goal for this year, and how we hope to meet the goal with some new ideas. Resource Promotion Night has been chosen for November.

Historian- John Nally has updated the PAOE points for Historical and has already met the goal.

Webmaster- Nancy Roman discussed our Website and how she will be updating it every month.

Treasurer- All accounts have been handed over to our new treasurer Brian Simkins and a Financial Update was given.

Membership – Carolyn Arote discussed strategy for obtaining new members. Membership Promotion nights have been chosen for September and January. It was also discussed the PAOE points are to be updated monthly for membership promotion.

Student Activities- Brian Simkins discussed the strategy/planning for college and high school visits. It was also discussed the PAOE points are to be updated monthly for student activities.

Chapter Technology Transfer (CTTC)- Andrew Manos discussed that the chapter MBO for this year was sent over to the RVC for approval. It was also discussed the PAOE points are to be updated monthly for CTTC.

Open Discussion- The golf outing has been set for May 4, 2009.

There being no further business to come before the meeting, the meeting was adjourned at 6:14.

Andy Manos, LEED AP
Chapter Secretary

Long Island Chapter - Past Presidents

1958	H. Campbell, Jr. PE	1983	Leon Taub, PE
1959	Clyde Alston, PE	1984	Raymond Combs
1960	Sidney Walzer, PE	1985	Edward W. Hoffmann
1961	Sidney Gayle	1986	Jerome T. Norris, PE
1962	William Kane	1987	Abe Rubenstein, PE
1963	Louis Bloom	1988	Michael O'Rouke
1964	Milton Maxwell	1989	Mel Deimel
1965	Will Reichenback	1990	Robert Rabell
1966	Joseph Minton, PE	1991	Gerald Berman
1967	Irwin Miller	1992	Donald Stahl
1968	Walter Gilroy	1993	Ronald Kilcarr
1969	Charles Henry	1994	Jerald Griliches
1970	William Wright	1995	Walter Stark
1971	Louis Lenz	1996	Joe Marino
1972	Ronald Levine	1997	Norm Maxwell, PE
1973	Henry Schulman	1998	Alan Goerke, PE
1974	Myron Goldberg	1999	Frank Morgigno
1975	John N. Haarhaus	2000	Michael Gerazounis, PE
1976	Richard K. Ennis	2001	Ray Schmitt
1977	Kenneth A. Graff	2002	Steven M. Stein, PE
1978	Evans Lizardos, PE	2003	Andrew Braum, PE
1979	Albert Edelstein	2004	Claudio Darras, P.E.
1980	Ralph Butler	2005	Craig D. Marshall, P.E.
1981	Robert Rose, PE	2006	John Nally
1982	Timothy Murphy, PE	2007	Peter Gerazounis, P.E.

Student Activities

Attention Students: The October meeting is Student Night so come on out and enjoy an evening on ASHRAE. We invite all engineering students to join us in our monthly meetings and take advantage of our seminars. They are a great way to gain real life experience do some networking. We have invited our Regional Student Activities Chair to visit us this month and we look forward to have Richard Vehlow join us.

Student Activities: There are many great publications available to distribute and help grow our industry. Let me know if you have any science fairs or activities that we could present our material at. Here are some examples of brochures and program available.

- ASHRAE Student Guide - Math Counts - JETS

Senior Undergraduate Grants: The *ASHRAE Senior Undergraduate Project Grant Program* provides grants to engineering, technical and architectural schools worldwide with the goal of increasing student knowledge, learning and awareness of the HVAC&R industry through the design and construction of senior projects. Grants are to be used to fund equipment and supplies for senior projects and 2-year technical school projects that focus on ASHRAE-related topics. Grants may cover projects lasting from one academic term up to one year.

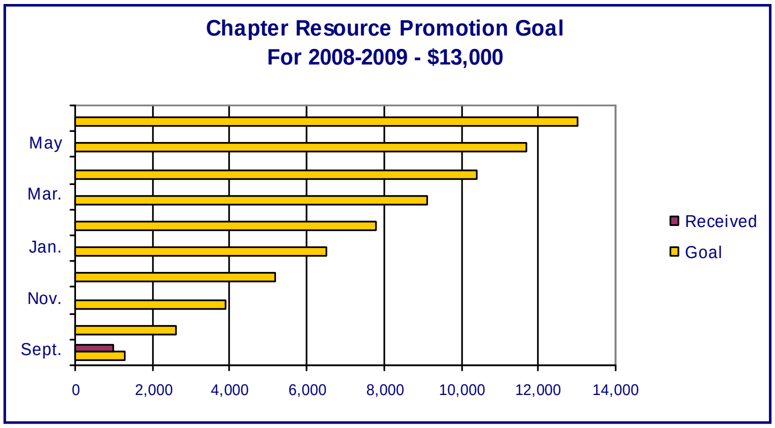
Learn More Here: http://www.ashrae.org/students/page/743 Please visit: http://www.ashrae.org/students/ for more information on all the Student ASHRAE activities and opportunities.

Brian Simkins - Student Activities Committee

Carolyn Cammalleri - Vice Chair

Research Promotion

As this year's Resource Promotion Chair, I would like to thank all of our contributors this past year. I hope to count on your continued financial support this year as well as new contributors.



ASHRAE is an invaluable tool to all of us and we owe it to ourselves to support new technologies and related research in any way we can. With over 90 current research projects on the board, ASHRAE continues to support professionals in our field with the design and application standards we rely on to do our jobs.

This year's overall resource promotion goal is $2.1 million dollars. Our chapter is expected to raise approximately $13,000.00 towards the overall goal. We continue to meet and exceed our financial goals yearly and all of your contributions help promote new standards to further HVAC technology.

Please mark your calendars – our November meeting is Resource Promotion Night. We hope to have all our past donors, as well as future donors attend.

You can contribute in two ways:

Please mail your checks, made out to Ashrae Resource Promotion, to:

Janeth Costa
Ashrae Research Promotion Chair
c/o Apollo HVAC Corp.
225 North Fehr Way
Bay Shore, NY 11706

OR contribute directly on-line. www.ashrae.org * Please make sure you accredit your contribution to the LONG ISLAND CHAPTER 006 *

Thank you again for all your past support and I look forward to a great year!

Janeth Costa
Resource Promotion Chair

Membership

We had a great turn out to our September Meeting, and we have 2 new members as of today. This is a great start to our year. Let's get motivated and invite some people down to the meetings. You know why it is beneficial to you, so spread the word and get a friend to join. If a new member joins at the dinner both you and the new member eat free for the night. I am also asking you to look into your membership and see if you are due for an upgrade. If you are an associate and have been for several years then it is time to upgrade to full member.

All you have to do is fill out an online application and you are automatically upgraded. If you think you might qualify just ask me or e-mail me at carote@adehvac.com and I will help determine if you can upgrade. It only takes minutes, but helps strengthen our chapter within the society.

See you at the next meeting, and if you have any questions please don't hesitate to ask…

Carolyn Arote
Membership Chairman

History - A Leader and Innovator

Our Long Island ASHRAE Chapter was extremely fortunate to have many talented and dedicated individuals who worked tirelessly to establish the infrastructure which has guided us throughout the years. In the early days, board meetings were held in private homes, the chapter treasury balance was only a few hundred dollars and the pencil and typewriter were the tools of the records keeper. Looking back almost fifty years ago to 1959 our past president was a gentleman named Clyde M. Alston. I have had the pleasure of professional dealings with Mr. Alston when he was alive and I will always remember his colorful bow ties. Here is a brief peak into his professional life.

Mr. Alston was definitely not a “desk top” engineer. From a construction worker on the Pittsburg, PA. job sites to Engineer-in-Charge of rehabilitation of utilities for the Tokyo District during the occupation of Japan, Mr. Alston had displayed the rare qualities of a talented professional who was equally at home in the mud of a construction site. A graduate of the Carnegie Institute of Technology, Mr. Alston studied advanced engineering at Polytechnic Institute of Brooklyn. During his professional career, he had served in various capacities as a Construction Engineer, Project Manager, member of the firm of V.P. Victor and Edwin T. Metcalf and as a partner in the firm of Bogen & Alston, Consulting Engineers. During World War II, Mr. Alston was a Captain in the Corps of Engineers. At that time he was Project Manager for the utility services at the Headquarters Camp of the Persian Gulf Command in Teheran, Iran, and Engineer-in-Charge of the aforementioned work during the American occupation of Japan.

In 1952, Mr. Alston became a partner in the firm of Bogen and Alston. The firm served as consultants on numerous commercial, industrial and public buildings. Mr. Alston began his own practice in 1958 under the name of Clyde M. Alston, Consulting Engineer, and since then was responsible for the mechanical engineering on a wide range of building types including banks, schools, recreational facilities, industrial plants, churches and special projects such as sewage plants, golf courses and atomic energy facilities.

In addition to his Certification of Qualification by the National Council of State Boards of Engineering Examiners, he was a licensed Professional Engineer in the States of New York, New Jersey, Pennsylvania, Connecticut, Virginia, Massachusetts and Ohio. Mr. Alston’s professional affiliations included membership in the National Society of Professional Engineers, the American Society of Mechanical Engineers, American Society of Sanitation Engineers, Construction Specifications Institute, Long Island Building Congress, N.Y. State Association of Professions, American Arbitration Association, and the Consulting Engineers Council. He was also a director and past president of the Nassau Chapter, N.Y. State Society of Professional Engineers, past president of the L.I Chapter of the American Society of Heating, Refrigeration and Air Conditioning Engineers, past president of the L.I. Chapter of the N.Y State Association of Consulting Engineers and past president of the Consulting Engineers Council of New York State.

Mr. Alston was also concerned with both civic and community affairs and had served as past president of the Kiwanis Club of New Hyde Park and was also the Village Engineer for that town. He was a School Board member on the New Hyde Park and Sewanaka School Districts and was also a member of the Hempstead Rotary Club. Mr. Alston was also a past president of the N.Y Clan if Carnegie Tech. Alumni and served as a Carnegie Tech. Alumni Advisor.

Over the years Mr. Alston’s firm was responsible for the mechanical design in a number of facilities on Long Island and many of the building still dot our landscape today. He was a founding father and strong supporter of our ASHRAE chapter and he is fondly remembered as a leader and innovator in our community.

John Nally
Chapter Historian

CTTC - Measuring OA Intake Rates

Approximately 1 quad of energy, costing $7.2 billion, is used annually for conditioning the OA ventilation air supplied to U.S. commercial, institutional, and government, buildings. The rate of OA ventilation also affects occupant health. In cross-sectional studies of buildings with various rates of OA ventilation, lower ventilation rates have been associated with increased respiratory illnesses (e.g., common colds), increased sick building syndrome symptoms, and diminished satisfaction with IAQ. Recent data indicate that lower OA ventilation rates also are associated with small decrements in work performance. Clearly, a need exists to strike a balance between the benefits of increased OA ventilation and the beneficial energy savings from reduced OA ventilation.

Despite the substantial influences of OA ventilation on energy use, health and performance, most U.S. buildings do not have a system for measuring the OA intake rates of HVAC systems continuously or even periodically. Given the absence of measurement systems, it is not surprising that minimum OA ventilation rates measured in surveys vary widely and often differ substantially from the ventilation rates specified in codes and in design documents.

Available data indicate that average OA ventilation rates in office buildings substantially exceed code requirements, imply-ing an opportunity for energy savings. However, a significant fraction of office buildings still provide less OA than specified in codes. Based on high measured CO_2 concentrations in classrooms, a majority of classrooms have less OA ventilation than specified in codes.

Accurate measurements of OA intake rates are challenging because OA intake velocities are kept low to minimize the amount of rain and snow drawn into the air handler. When the OA inlet is sized for the entire OA intake flow during economizer operation, the result is particularly low OA intake velocities, near or below the detection limits of many velocity sensors, during periods of minimum OA intake when measurements are most important. The geometry of the OA intake and its impact on velocity pro-files, and limited accessibility of the OA intake in some HVAC systems, further complicates the measurements.

The outdoor air passes through a bird screen, a set of louvers, and an OA damper. Downstream of the louvers or OA dampers the speed and direction of airflow will normally vary markedly across the flow cross section. Thus, averaging of velocity mea-surements made at a few locations in the cross section can lead to large measurement errors. Although these challenges and the need for better measurement and control of OA intake rates have long been recognized, until recently there has been only moderate progress toward meeting this need. A recent review article9 summarizes much of the recent research.

To address this problem, several manufacturers now offer technologies for direct realtime measurement of the rate of airflow through the OA intake. This article describes results of tests of three technologies that performed reasonably well (e.g., errors of a few percent to 25% in laboratory studies) and provides guidance on how these technologies should be used.

Evaluation Methods

The accuracy of measurement technologies (MTs) marketed for measuring rates of OA intake was assessed for a range of OA intake rates and air recirculation rates in a laboratory test system with a 2 ft by 2 ft OA intake louver and duct. Highly accurate reference flow meters (rated ±0.5% of flow) that contain an airflow straightener, a nozzle, and an array of pitot-like sensors were used to determine the “true” OA flow rates for comparison to the flow rates indicated by the MTs being evaluated. A calibrated research grade self-zeroing pressure transducer that is more accurate but more expensive than transducers normally used in buildings, with rated accuracy of ±0.001 in. of water or ± 1% of reading, was used to measure the pressure signals from the MTs.

Cont’d on Page 10

CTTC - Measuring OA Intake Rates (Cont'd from Page 9)

Accuracy of Three Measurement Technologies

Measurement technology 1 (MT1), depicted in *Figure 1*, in-tegrates a set of vertical louver blades with downstream air-flow sensing blades that extend the height of the louver system and that are centered between adjacent blades of the louver. No additional intake louver is required. The manufacturer's calibration curve relates the average air velocity through the free-area of the louver with the pressure signal from the airflow sensing blades.

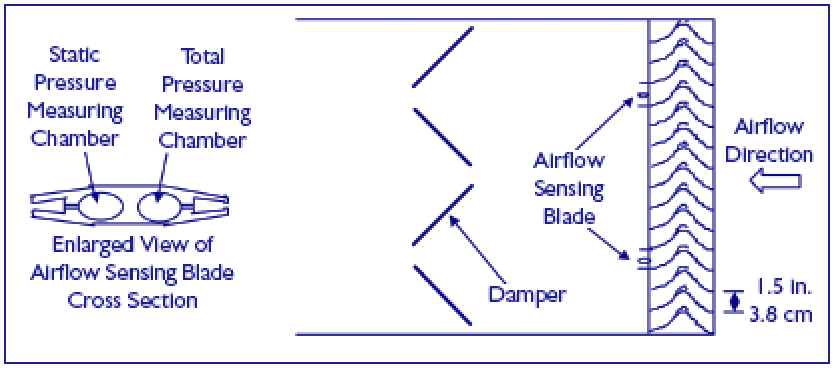


Figure 1: Illustration of MT1. Top views of cross section of the louvers and airflow sensing blades, and a side view of the OA damper are shown. The bird screen present upstream of the louver is not shown.

Figure 2 shows the accuracy of MT1 plotted vs. the reference OA flow rate. The figure includes results of tests with 10% OA to 100% OA. MT1 was accurate within approxi-mately ±20% for outdoor airflow rates exceeding approximately 250 cfm, corresponding to nominal intake velocities exceeding 62 fpm. The pressure signal from MT1 was 0.23 in. of water with the maximum recommended air velocity in the louver. Such a pressure difference can be measured accurately with commercial pressure transducers.

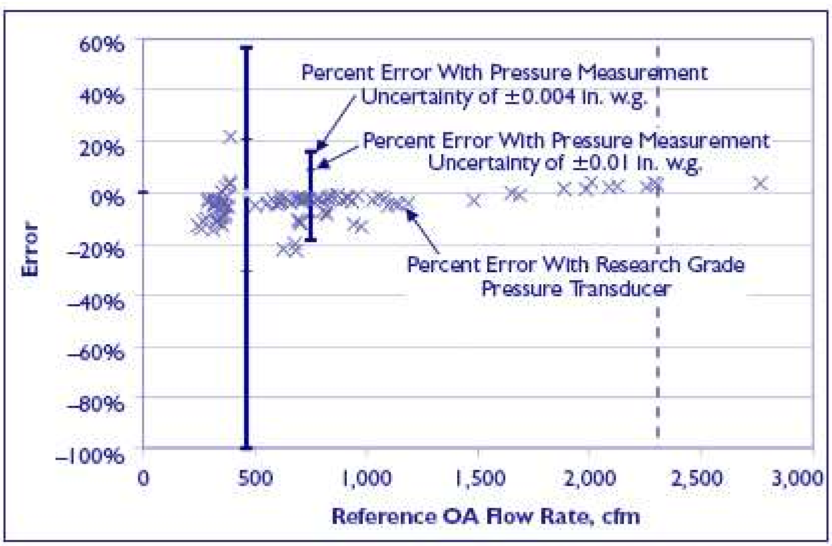


Figure 2: Accuracy of MT1 vs. reference OA flow rate. The dashed vertical line marks 100% of the recommended maximum rate of flow through the louver (to prevent excessive moisture intake) and the left-most set of error bars is positioned at 20% of the recommended rate of flow through the louver.

Cont'd on Page 11

CTTC - Measuring OA Intake Rates (Cont'd from Page 10)

However, at 20% of the maximum recommended velocity in the louver, which would be expected in an HVAC system with an economizer that had only one OA damper, the pressure signal was only 0.007 in. of water, which is difficult to measure accurately with the pressure transducers marketed for HVAC applications.

Therefore, for two OA flow rates, *Figure 2* includes error bars illustrating the expected errors in OA flow rates with errors in differential pressure measurement of ±0.004 and ±0.01 in. of water, which are assumed to be more typical of the errors that occur with the electronic pressure transduc-ers commonly used HVAC systems. With an error in pressure measurement of ± 0.01 in. of water, the corresponding error in OA flow rate is as large as –100% at 20% of the recommended maximum rate of flow through the louver.

Under the same conditions, if pressure measurement errors can be limited to ±0.004 in. of water, the maximum error in OA flow rate measurement is about –30% to +20%. As OA flow rates increase, the percentage errors from inac-curate pressure measurements decrease dramatically because

The pressure signal becomes larger and is more accurately measured. Also, the low-pressure signals can be avoided by using two OA dampers in parallel—one for the minimum OA intake and a second damper, which must have low leakage when closed, for the increased OA intake during economizer operation. Based on an examination of the test data, the ac-curacy of MT1 was nearly independent of percent OA (i.e., the amount of air recirculation), with the rate of OA intake held constant.

MT3 (*Figure 3*) uses a special static pressure tap at the outdoor face of the OA inlet and another type of static pres-sure tap, called an "inlet airflow sensor" downstream of the OA louver to sense the pressure drop across the louver. The outdoor pressure tap, mounted on or near the inlet face of the louver system, appears to be designed to provide a pressure signal unaffected by wind direction. The inlet airflow sensor is a 0.5 in. diameter, 5 in. long cylinder with a 0.8 in. long sintered metal end that is inserted through a duct wall.

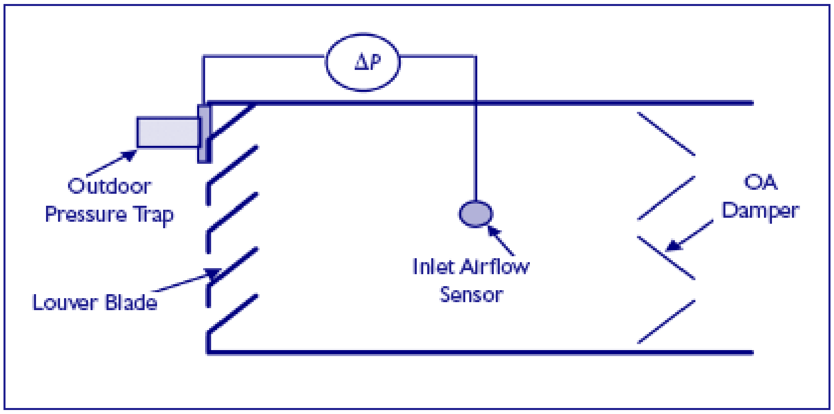


Figure 3: Schematic illustration of MT3.

The full MT3 system comes with a pressure transducer, tem-perature sensor to enable control for air density, electronics, and a digital display. The system has a manufacturer's rated accuracy of **±**5% of the reading. The relationship of measured pressure drop to OA flow rate varies with the design of the louver and must, therefore, be determined via a factory or field-based determination of this relationship.

MT3 was tested using three types of louvers placed upstream. Louver 1 (L1) is identical to the louver depicted in *Figure 1,* but has no airflow measurement blades. The air exits L1 directed predominately parallel to the duct walls. L2 is a traditional horizontal blade louver from which the outlet air has an upward trajectory, and L3 is a horizontal blade sight-proof louver from which the outlet air has a downward trajectory.

Cont'd on Page 12

CTTC - Measuring OA Intake Rates (Cont'd from Page 11)

Figure 4 shows an example of how the OA flow rates predicted using MT3 relate to the reference OA flow rates. The data shown were collected using L1. The predicted flow rate, based on the pres-sure signal of MT3, was well correlated with the reference flow rate (R2 = 0.99) and, on average, the predicted flow rate was 24% high.

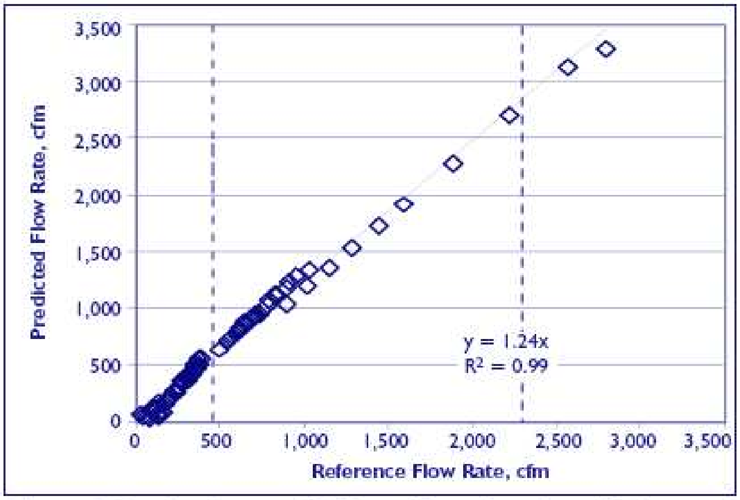


Figure 4: Results of tests of MT3 used in conjunction with Louver 1. The dashed vertical lines mark 100% and 20% of the recommended maximum flow rate through the louver.

When tests were repeated with the inlet airflow sensor at a different location downstream of L1, the predicted flow rate was high by 20% and the correlation remained high (R2 = 1.00). In tests with L2, the predicted flow rate was 28% high (R2 = 1.00). In tests with L3, the static taps of three pitot-static tubes were placed downstream of L3 in place of the inlet air-flow sensor. The correlation between pre-dicted and reference flow rate remained very high (R2 = 1.00) and the pre-dicted flow rate was 20% higher than the refer-ence flow rate. While better accuracy in measurements of OA flow rates may be desired, OA flow rate data with 20% to 30% errors are preferable to having no real-time data on OA flow, which is the typical situation. If an accurate field-based calibration could be performed, measure-ment errors would be smaller.

MT4 (*Figure 5*) contains a honeycomb airflow straightener upstream of a set of airflow monitoring blades, followed by a section of straight ductwork and then an OA damper. The airflow monitoring blades are identical to those used in MT1. The measurement concept appears to be to straighten the airflow, determine an average velocity from a pressure signal obtained from the airflow monitoring blades, and provide some straight duct downstream of the airflow monitoring blades to isolate the blades from airflow disturbances at the OA damper.

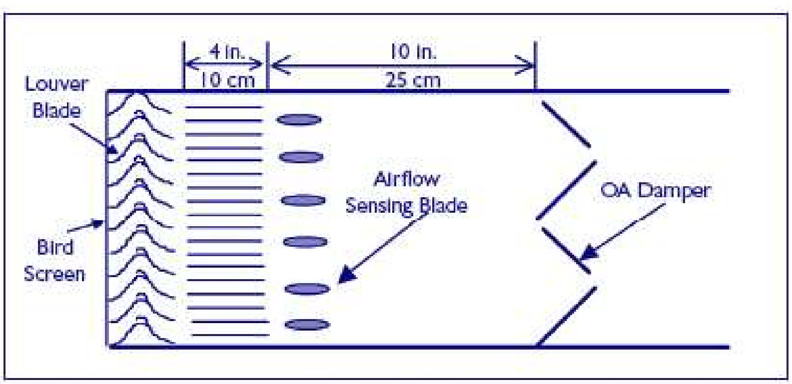


Figure 5: Illustration of MT4. For illustrative purposes, a top view cross section of the louver is shown, while a side view cross section is depicted for all other components of MT4.

Cont'd on Page 13

CTTC - Measuring OA Intake Rates (Cont'd from Page 12)

The manufacturer's recommended velocity range is 400 to 5,000 fpm, which corresponds to 1,600 to 20,000 cfm for a 2 ft by 2 ft duct. The manufacturer's rated accuracy is ±3% for standard test conditions with an upstream section of straight duct. In tests, MT4 was installed downstream of L1. The unit can be supplied with a pressure trans-ducer, actuators, and controls.

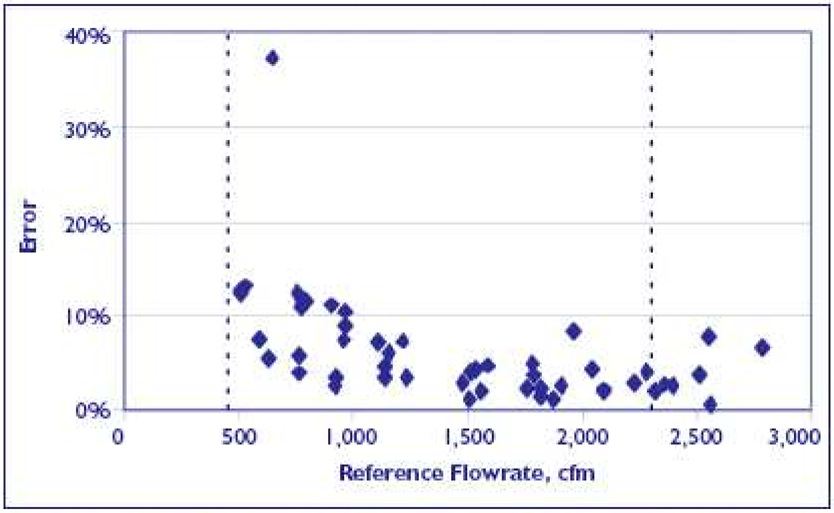


Figure 6: Percent error in measurements of flow rate with MT4 installed downstream of L1 vs. reference flow rate. The dashed vertical lines mark 100% and 20% of the manufacturer's maximum recommended rate of flow through L1, respectively.

Figure 6 shows the error in the flow rate measurement vs. reference flow rate. The error is less than ±10% for flow rates exceeding 1,000 cfm. All data points indicating an error larger than ±10% are from tests with a pressure signal smaller than 0.01 in of water. The tests conditions included 5% OA to 100% OA and the measurement error was unrelated to percent OA, with OA flow rate held constant. The manufacturer's minimum recom-mended flow rate for MT4 is 1,600 cfm.

Thus, for flow rates in the recommended range the error us-ing research grade pressure transducer was less than 10%. At 1,600 cfm, the pressure signal was approximately 0.03 in. of water. If the pressure measurement uncer-tainty with a practi-cal pressure transducer was 0.01 in. of water, the associated uncertainty range in the measurement of OA flow rate would be –10% to +16%.

Data from field testing indicate that the OA flow rates measured with MT4 have substantially larger errors when MT4 is used with an upstream horizontal-blade louver from which air exits with an upward trajectory. Thus, to maintain high meas-urement accuracy with MT4, it may be necessary to use L1 or some other louver with an outlet airflow that is predomi-nately parallel to the duct walls.

The pressure signal from MT4 is relatively small (0.053 in. of water) even with the maximum recommended rate of flow through L1. At 20% of the maximum recommended flow rate, the pressure signal is very small and con-sequently difficult to measure accurately with the pressure sensors marketed for HVAC applications.

None of the MTs tested create large pressure drops that are likely to be judged unacceptable with respect to fan capacity and fan energy use. Thus, pressure drop limitations do not appear to be a barrier to measurement of OA flow rates into HVAC systems.

Cont'd on Page 14

CTTC - Infrared Radiant Heaters (Cont'd from Page 13)

Effective Application of These Technologies

The small pressure signals provided by these technologies seem to be the main factor limiting the accuracy of the measurements of OA flow rates. To maintain measurement accu-racy, it will be necessary to use a pressure transducer with a full-scale range not much larger than the maximum anticipated pressure signal. Calculations indicate that percentage er-ror in flow rate, due solely to a pressure measurement error, is roughly half of the percentage error in the pressure signal measurement, e.g., a 20% error in pressure measurement, leads to a 10% error in flow rate. Thus, one might design for a 20% error in the smallest anticipated pressure signal, and benefit from smaller errors when the pressure signal is larger.

If the HVAC system has an econo-mizer, to maintain a sufficient pressure signal, the OA intake can be divided into two sections, each with a separate OA damper. The damper that is closed during minimum OA intake must have a low rate of air leakage. The economizer control system and associated controls must be designed to maintain rates of OA flow through the measurement technologies that are sufficient to produce a accurately measured pressure signals when rates of OA supply are minimized.

To measure accurately with MT4 when placed immediately downstream of the OA intake louver, it may be necessary to use a louver with an outlet airflow that is pre-dominately parallel to the duct walls. Research also indicates that maintaining a pressure drop of at least 0.04 in. of water across the OA damper can help to maintain a high measurement accuracy. In a limited program of field research, it was evaluated whether measurement accu-racy is maintained when the OA intake is subject to winds. In these studies, neither wind speed nor wind direction apprecia-bly affected measurement accuracy of the three MTs discussed in this article. Also, this research showed that some of the pressure transducers marketed for use with commercial HVAC systems were sufficiently accurate for this application. Maintenance requirements and the re-quired frequency of pressure transducer calibration were not studied.

Conclusions

Rates of OA ventilation should be monitored and well controlled because prior research indicates these rates substantially affect building energy use and occupant health. The available data indicates that OA supply rates are often poorly controlled. Some of the commercially available systems, when used properly, can measure the rate of outdoor air intake with errors of 20% or less. Design of the OA intake systems to avoid low pressure signals and the use of accurate pressure transducers are keys to accurate measurements of OA flow rate. With real-time data on OA flows, substan-tial improvements in control of OA supply to buildings should be possible.

Andrew Manos
Chapter Technologies Transfer Committee Chair

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