

## Mass Airflow vs. Volumetric Airflow

Mike Rosenberg

---

---

---

---

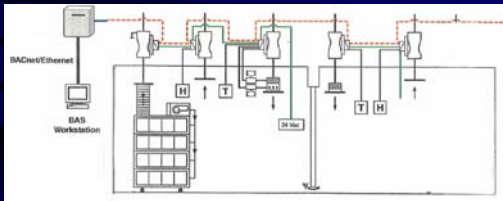
---

---

---

---

## Typical Airflow Relationship of Animal Holding Room



Mike Rosenberg

14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

---

## Statement of Problem

- TAB contractor would balance supply and exhaust valves to maintain differential offset of animal holding rooms to corridor
- There was no consistency when it came to measuring airflow from the grilles and diffusers and what was read at the BAS
- Airflows would drift over time

Mike Rosenberg

14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

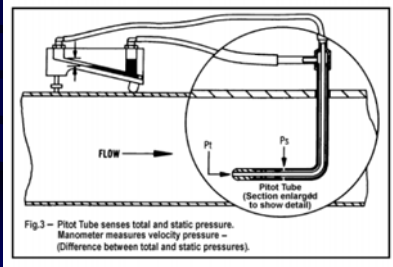
---

---

---

---

$$Cfm = Area (ft^2) \times 4005 \sqrt{vp}$$



Mike Rosenberg

14<sup>th</sup> NCBC - Amazing Findings

---

---

---

---

---

---

---

---

## Sample Conversion

- Duct size = 14" round = 1.069ft<sup>2</sup>
- V<sub>p</sub> = .047"wg
- $\sqrt{.047} = .2168$
- CFM = 1.069 x 4005 x .2168
- CFM = 928

Mike Rosenberg

14<sup>th</sup> NCBC - Amazing Findings

---

---

---

---

---

---

---

---

## What we Knew

- We had a typical Titus VAV box with flowcross airflow sensor
- Calculations within the BAS were correct for taking the amplified VP reading and converting it to actual cfm
- The VP read directly at the flowcross was inconsistent with the VP read at the BAS

Mike Rosenberg

14<sup>th</sup> NCBC - Amazing Findings

---

---

---

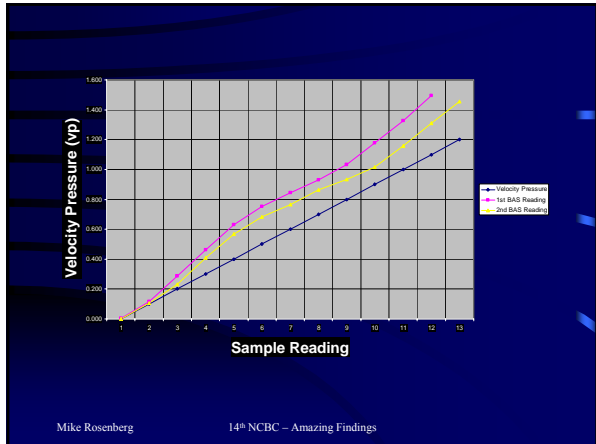
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

## Mass Airflow Sensors

**Mass Airflow Sensors**



**Overview**  
Mass Airflow sensors contain a thin-film, thermally isolated bridge structure that contains both heater and temperature sensing elements. The bridge structure provides a sensitive and fast response to changes in airflow or other gasses over the chip.

**Best Used For:**  
Air pollution instrumentation, HVAC damper control, gas analyzers, medical equipment, process control.

Mike Rosenberg 14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

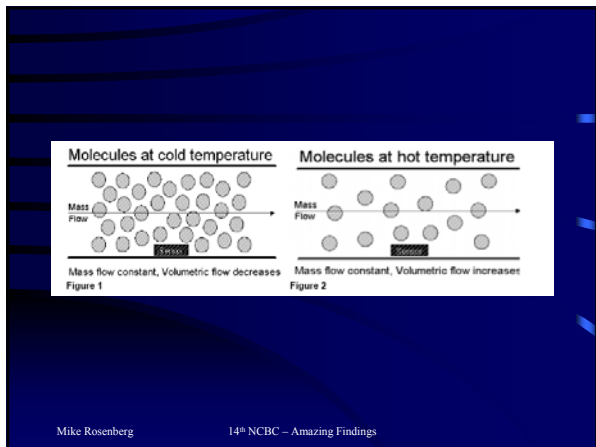
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

## Mass Airflow changes Proportionally to changes in Temperature or Pressure

$$CFM_2 = CFM_1 \cdot \frac{P_1}{P_2} \cdot \frac{T_2}{T_1}$$

Mike Rosenberg

14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

---

---

---

---

---

## Sample

- $CFM_1 = 500$
- $P_1 = P_2 = \text{Constant}$
- $T_1 = 55^\circ\text{F}$
- $T_2 = 58^\circ\text{F}$
- $CFM_2 = CFM_1 \times P_1/P_2 \cdot T_2/T_1$
- $CFM_2 = 500 \times 1 \times 1.055$
- $CFM_2 = 527\text{cfm}$

Mike Rosenberg

14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

---

---

---

---

---

Airflow Sensors		AWM3000 Series										
Microbridge Mass Airflow/Amplified												
OUTPUT FLOW VS INTERCHANGABILITY (Note 1)						Performance Characteristics @ 10.0 Vdc +/- 0.01 Vdc, 25 °C						
AWM3100V			AWM3150V			AWM3200V (Note 2)			AWM3300V			
Press Flow	Nom. Tol.		Press Flow	Nom. Tol.		Flow	Press. Nom. Tol.		Press Flow	Nom. Tol.		
mbar	sccm	Vdc +/-Vdc	mbar	sccm	Vdc +/-Vdc	sccm	in H <sub>2</sub> O Vdc +/-Vdc		mbar	sccm	Vdc +/-Vdc	
0.49	200	±0.05	2.50	30	±0.75	0.70	60.0	2.00	0.05	3.40	1000	±0.15
0.42	175	±0.05	1.70	20	±0.50	0.45	53.0	1.75	±0.05	2.90	900	±0.16
0.35	150	±0.17	0.84	10	±0.195	0.20	46.0	1.50	±0.16	2.40	800	±0.17
0.28	125	±0.17	0.18	0.42	±0.150	0.10	38.0	1.25	±0.20	2.00	700	±0.18
0.21	100	±0.375	0.19	0.34	±0.140	0.08	30.0	1.00	±0.22	1.60	600	±0.19
0.14	75	±0.27	0.19	0.26	±0.130	0.08	23.0	0.75	±0.22	1.20	500	±0.20
0.09	50	±0.20	0.17	0.17	±0.120	0.07	16.0	0.50	±0.19	0.80	400	±0.21
0.04	20	±0.100	0.13	0.08	±0.110	0.06	8.0	0.25	±0.11	0.54	300	±0.19
0.00	0	±0.100	0.05	0.00	±0.100	0.05	0.0	0.00	±0.08	0.31	200	±0.17
									0.12	100	±0.30	0.14
									0.00	0	±0.100	0.10

Notes:  
 1. Numbers in **BOLD** type indicate calibration type, mass flow or differential pressure. Tolerance values apply to calibration type only.  
 2. Differential pressure calibrated devices are not recommended for flow measurement. Use flow calibrated devices for flow measurement.

Mike Rosenberg

14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

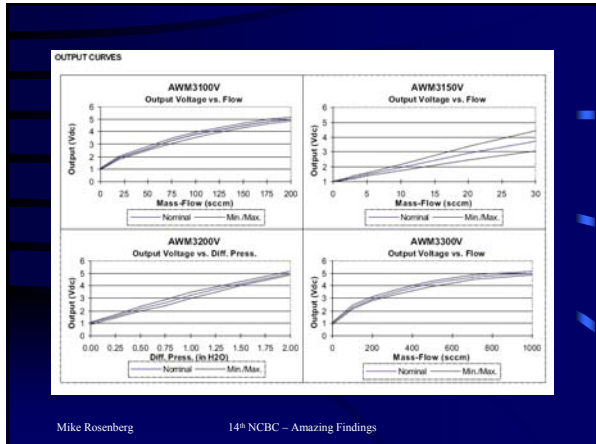
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

## Amazing Finding

- The microbridge mass flow sensor used to measure differential pressure was a misapplication of the sensor.
- The microbridge mass flow sensor was replaced with a standard differential pressure sensor to correct the problem.

Mike Rosenberg 14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

---

---

---

---

---

## Thank You

Mike Rosenberg 14<sup>th</sup> NCBC – Amazing Findings

---

---

---

---

---

---

---

---

---

---

---

---