M&P

Air Components, Inc.

M & P Air Components, Inc. provides Components, Technologies, Guidelines, Sales and Technical Services for Industrial Air and Dry Solids Processes.

Our Goal is to provide Clients with the correct components selection and system design to achieve the best Utilization, Reliability, Safety and Economy for their plant processes.

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Technical Bulletin

Fan System Testing **TB.40.0.04**

The *Pitot Tube* is a tube within a tube, using an inner tube for total pressure, an outer tube for static pressure, and both tubes connected for velocity pressure. Its tip must be directly in line with the airflow, with the stem perpendicular to the duct and the static pressure leg parallel to the duct. It is accurate for velocities 1500 fpm and higher.

For static pressure, the Pitot Tube should be inserted to the duct centerline at 3 equally spaced locations. For velocity pressure, the insertion points must represent equally spaced annular areas. The Pitot Tube is also useful for determining airflow spin.

Velocity Traverse Points for round duct should include at least 2 traverses along perpendicular diameters with 10 points each. Optimum accuracy is achieved with 8 points along 3 traverse diameters

Velocity Pressure measurements should be taken at least 7 diameters downstream or 3 diameters upstream of any disturbance.

Static Pressure measurements should be taken 2 to 6 diameters downstream or 1 to 3 diameters upstream of any disturbance, and at 3 equally spaced locations using 1/16 in. diameter holes, without burrs. The static pressure should be averaged from these locations.

For poor conditions where a desired location is not possible, at least 2 perpendicular traverses must be taken to achieve an accuracy of within +/- 6 %.

A *U-Tube or Inclined Manometer* is recommended for reliable pressure readings. When reading the manometer, add the sum of each leg to obtain the actual pressure

Airstream Conditions should be corrected for changes in temperature, altitude, pressure, moisture and molecular weight.

Standard density of 0.075 lbm/cu ft is used @ 70 F, +/- 30 F, +/- 20 in wg pressure, +/- 1,000 ft sea level, 0.02 lb water/lb dry air, or less, and 28.964 mol wt.

Calculating Airflow Using Velocity Pressure

- Measure velocity pressures
- Compute the individual velocities
- Compute the average velocity
- Multiply the average velocity x the duct area

Calculating Airflow Using Hood Static Pressure

Since Static Pressure is proportional to Velocity Pressure, then Velocity Pressure can be computed from measured Hood Static Pressure if the Hood Loss Coefficient (he) is also known. This allows airflow to be monitored based on Hood Static Pressure.

Calculating Airflow Using The Pipe Factor

Since the duct velocity is generally lowest at the skin and increases toward its centerline, the centerline velocity normally overstates the average velocity and should not be used unless corrected using the *Pipe Factor*.

The *Pipe Factor* is the ratio of the average duct velocity to the average duct centerline velocity.

Using at least 2 perpendicular traverses, calculate the average duct velocity and the average duct centerline velocity, then calculate the Pipe Factor. The Pipe Factor can then be used for future checks by multiplying it times the average centerline velocity – as long as the system is unchanged.

System Tolerance AMCA tolerances are +/- 2.5 % on flow and +/- 5 % on pressure for the fan, and +/- 25 % for the system. Combined, AMCA acceptance is +/- 10% tolerance on flow.

Useful Formulae:

Velocity (fpm)	$V = (1096.2)\sqrt{VP \div density}$
Volume (cfm)	$Q = AV$
Area (ft^2)	$A = \pi d^2 \div [(4)(144)]$
Hood SP (in.wg)	$SP_h = h_e + VP_d$ (simple hood)

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