Fundamental Fred

Explains It All

Hello there! I'm Fundamental Fred. In my inaugural edition, I would like to explain how airflow measuring stations work and offer guidance on selecting differential pressure transducers for airflow measuring stations. I assure you, I'll stick only to the fundamentals. Join me, won't you?

Airflow measuring stations, like Kele's **KMS Series**, are typically made up of copper tubing dotted with lots of holes. The copper tubing is spread across a galvanized sheet steel frame with a honeycomb-shaped air-straightening device. The air enters through the straightening device and passes over the copper tubing with the holes, creating pressure inside the copper tubing that varies with airflow.

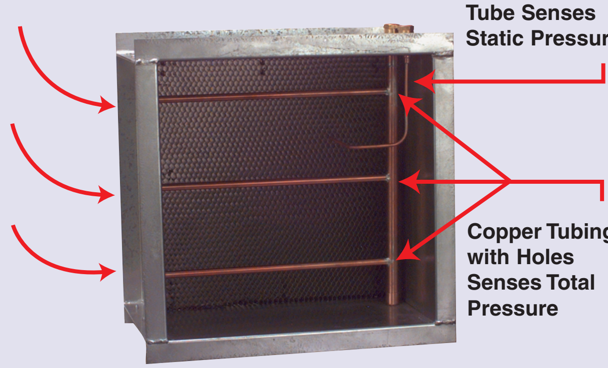
Inside the airflow measuring station, there is also another smaller copper tube that exits the airflow measuring station right next to the long copper tube. Why? Well, the applicable calculations for airflow involve velocity pressure. Velocity pressure is not easy to sense using practical means. It is much easier to arrive at velocity pressure by sensing total pressure and subtracting the static pressure from it, as shown below.

Velocity Pressure =

Total Pressure – Static Pressure

The copper tubing that is spread through the airflow measuring station senses total pressure. The smaller copper tube senses static pressure. The differential across the two ports that are at the ends of the long and short copper tubes, usually located on the top or side of the airflow measuring station, represents the velocity pressure.

Kele KMS Airflow Measuring Station



Now that both static pressure and total pressure can be sensed, a differential pressure transmitter, such as the **T30**, **M264**, or the high accuracy **XLdp** is used to measure velocity pressure. Selecting the scale for a differential pressure transducer for an airflow measuring station can be done using the following equation:

$$\text{Max Velocity Pressure ("W.C.)} = (\text{Max CFM}/\text{Effective Area}/4005)^2$$

Where, **Max CFM** - the maximum flow rate in cubic feet per minute for which the duct is designed.

Effective Area – the free cross-sectional area of the airflow measuring station in square feet, usually stamped on the station's label (if given in square inches, divide by 144).

4005 – a constant, applicable to true velocity pressure of air at temperatures and humidity levels normally found in HVAC work. (Please note that this number may vary if your airflow station is designed to amplify the pressure difference. Consult your Kele Technical Sales Representative if you're unsure.)

The number you get from this calculation will represent, in "W.C., the maximum velocity pressure determined by the duct size and maximum flow rate for which the duct was designed. It will also provide a range for selecting the most appropriate differential pressure transmitter for your application. See an example of this calculation in use below:

If a duct is 24"H x 24"W, a Kele **KMS-911-24 X 24** airflow measuring station is a good choice. Although the duct area is 4 ft^2, the effective area stamped on the label of the airflow station is only 3.67 ft^2 since the area of the tubing and straighteners must be subtracted out. We also must determine the design maximum flow. In our case, it is 5000 CFM, which we have determined by consulting the mechanical system drawings.

Therefore, $$\text{Max Velocity Pressure} = (5000/3.67/4005)^2$$

$$= (.340)^2$$

$$= 0.116 \text{ "W.C.}$$

In selecting the next higher range Δp transmitter to allow some headroom, we would choose a range of 0-0.2 "W.C.

I hope this helps in a most fundamental way. If you have further comments or questions, e-mail me at fundamentalfred@kele.com. Also, drop by www.kele.com to check out our nifty Formula Wizard. It will help you easily determine conversions for temperature, power factor, air velocity, and much more. See you next time!

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