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Bringing Sensible Solutions to Difficult Problems

UNDERSTANDING CALIBRATED AIR FLOW

What is SCFH (Standard Cubic Feet per Hour) or SLPM (Standard Liters per Minute)

When the typical air flow meter is installed, the paperwork in the box gets tossed because the device is so simple… Or is it? The next time you open a new air flow meter, take a close look at the instructions that come with it. You will find reference to the following confusing formula:

$$Q_2 = Q_1 \times \sqrt{\frac{P_1 \times T_2}{P_2 \times T_1}}$$

Where:
Q_1 = Actual or Observed Flowmeter Reading
Q_2 = Standard Flow Corrected for Pressure and Temp
P_1 = Actual Pressure (14.7 psia + Gage Pressure at Exit)
P_2 = Standard Pressure (14.7 psia which is 0 psig)
T_1 = Actual Temperature (460 R + Temp in F)
T_2 = Standard Temperature (530 R (70 deg F)

As air passes through the meter or "rotometer" as it is sometimes called, the device reacts to the volume of air passing through it and gives an indication of how much air is passing through. But what if the air passing through the meter is compressed? Compression causes a smaller volume for the same amount of air, giving a lower air flow reading as it passes through. By the same token, if the air passing through the meter is at a negative pressure (drawn or "sucked" through the meter), the reading will be higher for the same amount of air flow. Also, as the temperature of the air increases, the air becomes "thinner", again effecting the reading of the air flow meter.

The above formula compensates for that pressure and temperature difference. The following examples show just how great that difference can be in a typical DAF aeration installation.

Typical DAF Aeration Applications

There are several different typical DAF Aeration Applications. The oldest is air injected into a saturation tank as in the older Carborundum DAF. The air was typically injected into the tank at a pressure of about 30 psi. In more recent DAF designs, air has been injected into the inlet of a turbine style pump at a very low inlet pressure of just a few pounds per square inch. In some installations such as the Edur pump and Nikuni pump, the inlet feed to the pump is restricted, creating a vacuum which "suctions" the air through the air flow meter and into the inlet of the pump at a negative pressure. In the case of the KeysTec Air-Whip pump, air is injected at a pressure slightly higher than the operating pressure of the pump, often at 100+ psi. So, you can see that the pressure of the air passing through the air flow meter can vary greatly.

How Much Does It Matter?

Based on the formula above, a direct reading of 15 CFH (cubic feet per hour) at a negative pressure of -5 psi and a temperature of 80 degrees is actually 12.1 SCFH (Standard Cubic Feed per Hour), corrected or calibrated to compensate for pressure and temperature. The same flow meter reading of 15 CFH with compressed air at 100 psi and 90 degrees F is actually 41.1 SCFH after calibration. That's over three times more air than in the first example with the exact same air flow meter reading. The KeysTec SCFH Calculator on the web site does the calculation for you. Visit www.keystec.com and click on DAF Knowledge Base for the calculator.