System Design Air Flow

Aeration Systems

Bulletin Brief

Technical Presentation

After evaluating the system process oxygen needs and computing an air flow how do I use the information to actually size my blowers or compute onsite air use?

When calculating process air supply for water and/or wastewater treatment the results are usually given as cfm, scfm, acfm, icfm or equivalent metric units using Nm3/hr. Proper understanding of these terms is critical to proper sizing or selection of air supply or blowers/compressors.

Most calculations for process air are based on STANDARD CONDITIONS. STANDARD CONDITIONS for air supply are indicated as a designated air flow in terms of reference pressure, reference temperature, and a relative humidity. The most common standard used is defined by the Compressed Air and Gas Institute (CAGI) and the American Society of Mechanical Engineers (ASME). This standard designates an air pressure of 14.7 PISA (pounds/square inch ABSOLUTE); 68°F, and 36% relative humidity. Under this definition of STANDARD CONDITIONS air has a density of 0.075 pounds/ft3 and a FIXED amount of OXYGEN is available for the process with each cubic foot of gas supplied. This value is used as part of the process air volume calculations; see EDI Technical Bulletin _____.

Since air is a compressible fluid (gas) any change in pressure, temperature, or humidity at the site can dramatically change the amount of oxygen available per cubic foot of gas; therefore; dramatically change the amount of process oxygen available. Site changes in pressure, temperature or relative humidity USUALLY result in LESS oxygen being available. The design or system may fail unless corrected for these site variables!

It is extremely important to understand how air volumes can be reported:

SCFM Standard cubic feet of air per minute-see definition above.

ACFM - Actual cubic feet air per minute (at the site). This measure is strictly a volume measure of air and does not provide any basis for determining what actual amount of oxygen is being delivered unless the following data is also provided.

a. Atmospheric pressure at the site generally provided as site elevation.
b. Temperatures (ambient air) at the site.
c. Relative humidity at the site.

ICFM - Inlet cubic feet of air per minute to a blower or compressor. This is generally the ACFM (site conditions) entering a blower/compressor.

CFM - Cubic foot of air/minute. NOT a descriptive term to be used in design but generally understood to be an ACFM volume of air to or from a blower or compressor. Great Care should be used when using or interpreting a CFM value.

NOTE: - Discharge CFM from a blower or compressor can be dramatically different form the inlet or ICFM. Obviously the blower or compressor has changed the 3 variables of pressure, temperature and relative humidity.

Design of blowers and/or compressors is beyond the scope of this technical bulletin. For process air calculations and blower or compressor air volumes and appropriate sizing of blowers/compressors and motors please confirm all designs with EDI or the machinery manufacturers.

Common mistakes when converting or using air volumes, blowers, compressors, etc., include:

a. Neglecting site evaluation. This can easily affect the amount of oxygen available for the process by up to 50%.
b. Neglecting relative humidity of the air into the blower inlet.
c. Ignoring site temperatures, particularly when the site has major swings of ambient temperature day/night or summer/winter, etc.
d. Using the process SCFM to size blowers without converting to ACFM at the site. Blowers are sized using ACFM so process requirements must be converted to ACFM. Note: ACFM/SCFM usually greater than 1.0.
e. Neglecting pressure loses before or at the blower inlet. Inlet losses must be added to total pressure differential.

For specific information on aeration system selection considerations, contact Environmental Dynamics Inc. at (573) 474-9456.

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