Understanding Air

IAOM – Western Canada District Meeting

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Air

• Air is a gas
  • *Nitrogen* (78%), *Oxygen* (20%)
• Colorless and Odorless
• Essential to plant and animal life
• We can’t see it, but we can feel it and see its effects

“As yet, the wind is an untamed and unharnessed force; and quite possibly one of the greatest discoveries hereafter to be made will be the taming and harnessing of it.”

- Abraham Lincoln, 1860
Harnessing Air

- Humans learned long ago the benefits of capturing and harnessing the power of air movement
Air for Process Systems
Understanding Air

• Air has mass
  – Weight = 14.7 psi at sea level
  – Density = 0.0765 lbs/cuft or Approx. 13 cuft/lb at sea level

• Elevation and temperature affect the density of air
  – Air is less dense at higher temperatures
  – Air is less dense at higher elevations

• Flows like water; takes the path of least resistance
Pneumatic Conveying

- Air has mass
- Greater mass requires greater horsepower
- Negative Pressure Conveying (centrifugal fan)
  - Typically higher volumes and lower pressures of air
  - Energy requirements affected by increased volume
- Positive Pressure Conveying (PD blower)
  - Typically lower volumes and higher pressures of air
  - Energy requirements affected by increased pressure
Pneumatic Conveying

- Calculations are based on moving a specified mass a specified distance at a specified velocity.
- All factors are relative and determine air volume and hp requirements.
FC11 Fan Performance Curve

Outlet area: 0.66 ft² Inside
Wheel Diameter: 19.125"
Wheel Circumference: 5.01 ft

Curves represent air at STP. Drive losses not included.
AIRFLOW AT INLET

AIRFLOW BASED UPON INLET CONDITIONS OF:
14.7 PSIA & 70°F

*PSIG DISCHARGE PRESSURE

INPUT POWER

CFM

BHP

RPM

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Air Filtration

- Effective air filtration is relative to volume
  - *Air to Cloth ratio*
- Velocity also factors into effective filtering
  - *Can velocity*
  - *Interstitial velocity*
- Pressure drop / resistance across dirty bags challenges the air mover and affects the entire air system
Airlock Leakage

- **Static air leakage**
  - *Air movement through valve due to open clearances*
  - *Worn clearances increase leakage*

- **Dynamic air leakage**
  - *Air loss from convey line taken away by “empty” pocket*
Proper Duct Design

- Good design requires appropriate air volume at effective velocity
- Any change to original design will impact the efficiency of the system
Good Velocity, Good Volume, Good Design

CORRECT MANIFOLD DESIGN

Dust is in suspension; System is balanced.
Bad Velocity, Good Volume, Bad Design

Dust is dropping out (in locations); System is balanced (at end of system).

By using a straight duct design with several pickup points the velocity (FPM) of the air in the duct will be low and dust/product will fall out of the air stream and pile up.
Dust is NOT in suspension; System is NOT balanced. Air taking path of least resistance.
Air Measuring Kit
In Closing……

- Understand the equipment and processes that you have in operation
  - Understand system behavior in both optimal and upset conditions
- If in doubt or confused, rely on the manufacturer or system designer for advice
- Learn to identify and resolve issues before failures occur
- Regular and effective maintenance pays off
- BE SMART / BE SAFE

Always work smartly and practice safety!!
Thank you for the opportunity to speak with you today.