CONTINUOUSLY PREDICTABLE VENTILATION SYSTEMS

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By
Jonathan F. Hale
Jackson-Hale Environmental Technologies, Inc.,
Clemmons, NC, USA

Two types of LEV system resistance

- Fixed Resistance
- Dynamic Resistance
Fixed resistance stays the same

Dynamic Resistance fluctuates!
What volume is your local exhaust ventilation (LEV) system?

Are you sure that you have the right cfm for your system?
Sulfuric Acid sure? Hex chrome sure? Radionuclide sure?

Too Little System Flow Causes:

- Overexposed Employees
Too Much System Airflow Causes:

- Filter blinding due to overdesign air-to-media ratio,
- Loss of product due to excessive hood velocity,
- Excessive use of motor horsepower-$$\$
- Reduced filter life.

There are two ways to initiate control of a systems’ volume:

- Use of an inline Airflow Monitoring Station,
- Use of a Hood Static Pressure Sensor.
The Airflow in a duct varies with the Hood Static Pressure!

The higher the hood suction (available hood static pressure) the more the airflow.

**Hood Loss Coefficients**

<table>
<thead>
<tr>
<th>HOOD TYPE</th>
<th>DESCRIPTION</th>
<th>HOOD ENTRY LOSS (Fj) COEFFICIENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plank Opening</td>
<td></td>
<td>0.95</td>
</tr>
<tr>
<td>Flanged Opening</td>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td>Taper or Cone Hood</td>
<td></td>
<td>SEE CHAPTER 10</td>
</tr>
<tr>
<td>Bell Mouth Inlet</td>
<td></td>
<td>0.04</td>
</tr>
<tr>
<td>Office</td>
<td></td>
<td>SEE CHAPTER 10</td>
</tr>
<tr>
<td>Typical Grindung</td>
<td></td>
<td>(STRAIGHT TAKEOFF)</td>
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<tr>
<td></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(TAPERED TAKEOFF)</td>
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<tr>
<td></td>
<td></td>
<td>0.40</td>
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</table>
Acceleration “Losses”

- The energy required to accelerate air from a dead stop to the velocity in the duct ($V_{Pd}$).
- *Always Equals 1 Velocity Pressure!*

Hood Static Pressure

$$\text{Hood Entry Loss (}h_e\text{)} + \text{Acceleration Energy “Loss” (}V_{Pd}\text{)} = \text{Hood Static Pressure}$$
Hood “static pressure” transducer and sender

- It takes a reading in inches of water gage and sends out the reading as a variable 4-20 mA analog signal
Sample System

AIRFLOW MEASURING STATIONS
Multi-point Flow Measurement -- The Need

- Few installations have (8+) straight duct runs available.
- Two examples of different velocity profiles in the same duct at different rates of total airflow
PRI NCIPLE S OF AIRFLOW

Multi-point Flow Measurement - Traverse Readings

Accuracy of a traverse is proportional to the number of measurement points.

Round Duct Airflow Station
VOLU-probe/ Fi-SS
(Fan Inlets)

Pitot-Fechheimer probes mounted within the fan inlet bell. Good for measurement where no straight duct runs are available downstream of the fan discharge. Use with variable frequency drive, not variable in...
POINT VELOCITIES USING LOG-TCHEBYCHEFF METHOD

Rectangular Duct Airflow Station
I’ve Got Sticky-gooies, Wet nasties and Dry Abrasives in My System!

What about plugging?!?!

Change the pressure in the Pitot tube
Volume Control

Dollars per horsepower @ 85% motor efficiency

<table>
<thead>
<tr>
<th>$/KWH</th>
<th>.01</th>
<th>.02</th>
<th>.04</th>
<th>.06</th>
<th>.08</th>
<th>.10</th>
<th>.12</th>
<th>.14</th>
<th>.16</th>
<th>.18</th>
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<tbody>
<tr>
<td>1 hr.</td>
<td>$0.0088</td>
<td>.017</td>
<td>.035</td>
<td>.053</td>
<td>.07</td>
<td>.088</td>
<td>.105</td>
<td>.123</td>
<td>.141</td>
<td>.158</td>
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<tr>
<td>24 hr.</td>
<td>$ 0.21</td>
<td>.42</td>
<td>.84</td>
<td>1.26</td>
<td>1.68</td>
<td>2.10</td>
<td>2.52</td>
<td>2.94</td>
<td>3.36</td>
<td>3.78</td>
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<tr>
<td>1 year</td>
<td>$77.00</td>
<td>154</td>
<td>308</td>
<td>464</td>
<td>613</td>
<td>770</td>
<td>920</td>
<td>1078</td>
<td>1235</td>
<td>1385</td>
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Asphalt Condensables Filter
Monitor all hood Static Pressures!

A pressure monitor at every hood makes sure that you have the system balance the way that you did when you commissioned the system at start-up.

Your employees will help!

You have trouble with plugging of your static pressure ports?
Use an “S” type static pressure port-
It works on fertilizer, sugar, asphalt smoke and paint overspray
Time’s Up