Evaluation of Dust Collector Systems to Optimize Performance

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Why talk about dust collection?

“The accompanying phenomenon of comminution, handling and processing ... the material components which finally form Portland cement is the generation of dust.”

- from Duda’s Cement Data-Book
Typical 2000 mtpd cement plant

2000 mtpd = approx. 1400 kg/min of cement production

\[
\begin{array}{c}
2610 \text{ kg/min} \\
1400 \text{ kg/min}
\end{array}
= 1.9 \text{ kg of dust collected for every kg of cement produced!}
\]
Major components of a dust collection system

Dust Collector
Ductwork
Vent Hood
Dust Removal System
Fan
Basic concept of a dust collection system

Ideally, it’s not a dust collection system, it’s a dust containment or control system
Ultimate goal of a dust ventilation system

Provide maximum dust control and containment with a minimum of dust collection
Air flow or gas flow

The volumetric flow rate of air or gas per unit of time

Usual units are:

- Cubic feet per minute (cfm)
- Cubic meters per minute (m³/min)
- Cubic meters per hour (m³/h)
Major components of a dust ventilation system
Hood design

Vent points and hoods are probably the most overlooked component of a dust control system
For enclosure type hoods:

\[ Q = V \times A \]

- **Q** = Ventilation Airflow Rate (cfm)
- **V** = Capture Velocity (fpm)
- **A** = Total Open Area on Enclosure (sq. ft.)
Belt conveyor venting

Typical Design

Improved Design

Better Design

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Hood design
Hood design
Air conveyor venting

Typical Design

Improved Design

Better Design
Air conveyor venting
Bucket elevator ventilation

Typical Design

Improved Design

Better Design
Ball mill ventilation (open end end mill)

Poor design

Better design
Hood design – ball mills

Extend Mill Hood as High as Possible
Major components of a dust ventilation system
Air or gas flow in a duct

\[ Q = V \times A \]

- \( Q \) = Air or Gas Flow (cfm)
- \( V \) = Transport Velocity in Duct (fpm)
- \( A \) = Cross-Sectional Area of Duct (sq. ft.)
Duct design

Avoid

Acceptable

Recommended

Acceptable

Recommended

Radius @ CL is 1.5 x dia.

30° to 60°

Recommended

Recommended

Recommended

Recommended

Radius @ CL is 2 x dia.

30° to 60°
Duct design
Duct design
Ductwork balancing

Equal Areas

Blast Gate Damper Modification
Centralized venting concept
Decentralized point venting
Major components of a dust ventilation system
## Air-to-cloth ratio

<table>
<thead>
<tr>
<th>Type of filter cleaning system</th>
<th>Maximum recommended air-to-cloth ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaker</td>
<td>3.0</td>
</tr>
<tr>
<td>Reverse Air</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Pulse-Jet:</strong></td>
<td></td>
</tr>
<tr>
<td>A. Cylindrical Filter Bags</td>
<td>6.0</td>
</tr>
<tr>
<td>B. Pleated Filters (Non-Paper Media)</td>
<td>3.5</td>
</tr>
<tr>
<td>C. Pleated Filters (Paper Media)</td>
<td>2.0</td>
</tr>
<tr>
<td>Plenum Pulse</td>
<td>4.0</td>
</tr>
</tbody>
</table>
Can velocity

In a pulse jet dust collector with the filter elements suspended from the tubesheet, can velocity is the upward air stream speed passing between the filters calculated at the horizontal cross-sectional plane of the collector housing at the bottom of the filters.
Photohelic® gauge

An instrument used to measure and control baghouse differential pressure; having adjustable set points that can be used for starting and stopping the baghouse valve-firing timer board, to maintain a desired range of operating differential pressure.
Major components of a dust ventilation system
System curve

\[ SP = \text{Constant} \times Q^2 \]

Cubic Feet per minute (CFM)
System and fan curves

- **Flow Rate (Q)**
- **Pressure (P)**
- **Fan**
- **System**
- **Baghouse Pressure**
- **System Pressure**
- **Desired**
System effect
System effect
In conclusion

Make sure your systems are:

- Maximizing dust control and containment
- While minimizing dust collection