Dust Control on Continuous Mining Machines

Joy Mining Machinery
Topics

• Flooded Bed Dust Collector
• Machine Sprays
• Wethead Cutterhead
Flooded Bed Dust Collector

- FAN
- SUMP
- DEMISTER
- ATTENUATOR
- SCREEN
- AIR FLOW TEST POINTS

Mining New Opportunities
Flooded Bed Dust Collector

SIDE VIEW

SPRAY BAR  SCREEN  DEMISTER  BACKFLUSH SPRAY  SUMP DRAIN  FAN

TOP VIEW
Machine Configuration

- **Intake**
  - Chassis Duct Only
  - Dual Intake Chassis Duct
  - Boom Ductwork

- **Exhaust**
  - Standard
  - Cross Under Duct

- **Dual Scrubber**
Chassis Duct Only
Dual Intake Chassis Duct
Boom Ductwork w/ Cross Under Duct
Dual Scrubber
Duct Sprays

- **Standard Configuration**
  - (1) 70 degree hollow cone spray
  - 6.5 gpm @ 45 psi
  - Sprays screen parallel to air flow

- **Other configurations**
  - additional sprays
  - alternate spray flows
  - alternate spray angles
  - backflush sprays on screen
Screens

• Screen slows velocity of dust allowing the spray water and dust to mix
• Screens only “filter” large particles
• Screen set at angle to increase turbulence and increase overall screen surface area
• Woven steel mesh (.0035” wire)
• Pleated
• Layers (folded “sock” of mesh)
  - 10 layer (course)
  - 20 layer (standard)
  - 30 layer (fine)
• Polyurethane bound
Demister Box

- Removes water/dust mixture from air
- 90% efficient in removing respirable dust pulled into scrubber
- Dual, in-line demisters are an option
Slurry Removal

• Slurry collects under demister in sump area
• Removed via:
  - Centrifugal pump or
  - Venturi
• Slurry can be deposited in various locations
  - Conveyor throat (drop tube)
  - Conveyor
  - Gathering pan
  - Drums
• Axial Vane

• Horsepower / Flow (available)
  - 13 hp - 4000/3500 cfm (oper/min)
  - 13 hp (hi) - 4500/4000 cfm
  - 30 hp (low) - 6000/5400 cfm
  - 30 hp - 7000/6000 cfm
  - 30 hp (hi) - 8000/6500 cfm
  - 40 hp - 10,000/9000 cfm
Intake
Chassis Duct
Demister and Fan
Exhaust

Mining New Opportunities
**Maintenance**

- **2 X per shift**
  - Tap out contaminants on screen
  - Flush screen
- **Daily**
  - Flush inlets and ductwork w/ screen in place and screen cover open
- **Weekly**
  - Backflush slurry pump
  - Open sump drains
  - Flush demister
  - Flush sump
  - Dry screen and tap out contaminants
Troubleshooting

- Actual and Minimum cfm values listed on demister door
- If cfm drops below min value,
  - check fan blade tip / housing clearance is <.100” (.020” new)
    - if not, change fan
  - change screen mesh
  - clean scrubber
Testing Flow

- Flow tested on OEM and rebuild machines via Pitot tube method
- At test points in scrubber duct, the air velocity is recorded at every inch in height.
- The values are averaged and multiplied by the duct cross sectional area to determine volumetric flow
- The actual volumetric flow is recorded on the demister cover nameplate
Drawbacks to a FBDC

• Noise
  - Scubber attenuator
  - Sound dampening foam in duct
  - Fan wrapped in sound dampening insulation

• Maintenance

• Size
  - Determine height of machine
  - Take up a lot of useful space on machines
Machine Dust Sprays

- 70 degree hollow cone sprays (typ)
- 100 psi (typ)
- Spray bars can be located on
  - Top of boom (middle, right, and left) spraying on drums
  - Bottom of boom (middle, right, and left) spraying on drums
  - Side of boom spraying on end of drum
  - Conveyor throat spraying on conveyor
  - Gathering pan spraying above loading arms
  - Chassis spraying toward face/rib
  - Any other customer supplied location
- Typical boom spray arrangement designed to keep dust toward the face and allow dust to be collected by the scrubber
- Directional sprays on boom can be fitted to direct air flow across the face
- Venturi sprays (air moving) can be used in high methane areas to provide a concentration of air to particular location
Typical Boom Spray Arrangement
Typical Machine Spray Arrangement

- **L.H. CUTTER MOTOR SIDE COVER**
  - 3 SPRAYS SPRAYING DOWN PLUGGED

- **L.H. CHASSIS SPRAY**
  - 2 NOZZLES ON VERTICAL

- **DUCTWORK SPRAY**
  - 01566237-0040 NOZZLE

- **DUCTWORK CLEANING SPRAY**
  - 01566237-0006

- **R.H. CHASSIS SPRAY**
  - 2 NOZZLES ON VERTICAL

- **R.H. CUTTER MOTOR SIDE COVER**
  - 3 SPRAYS SPRAYING DOWN PLUGGED

- **L.H. END RING SPRAY**
  - 3 NOZZLES ON VERTICAL

- **L.H. CUTTER DRUM SPRAY**
  - (TOP & BOTTOM)

- **CENTER CUTTER DRUM SPRAY**
  - (TOP)

- **R.H. CUTTER DRUM SPRAY**
  - (TOP & BOTTOM)

- **R.H. END RING SPRAY**
  - 3 NOZZLES ON VERTICAL
The Joy WetHead Cutterhead

44” Cutter Diameter
Benefits: The Potential to Reduce...

- Dust levels
- Face ignition frequency
- Bit consumption
- Power consumption
- Machine wear
- Scrubber maintenance
- Machine Noise
- Water Consumption
- Lost Production Time
WetHead Features

- **Cutterhead Gearcase**
  - Same gearing and bearings of standard gearcase
  - Water porting sized for max flow / min pressure drop

- **Cutter Drums**
  - Thicker than standard drum shell
  - Internal water porting

- **Bit Blocks**
  - Integral water spray on each block
  - Design guided by Bretby established ITPP criteria
    - *Incendive Temperature Potential Protection*
WetHead Features

• Water Seal - “The Heart of the WetHead”
  - Single water seal design
  - Dual carbon-on-CrO seal faces
  - Anticipated life – 4000 hours!
  - Designed to relieve to atmosphere if seal faces were to fail – No water in oil!

• Water Circuit
  - Independent water circuit
  - 25 micron non-bypass filtration
  - Independent pressure regulation
Bit Block Spray Nozzle
Dust Study Results
(WetHead vs Standard)

- Independent third party dust evaluations by:
  - CSIR Miningtek
  - SIU (Southern Illinois University)
  - MSHA (Mining Safety and Health Administration)
  - NIOSH (National Institute for Occupational Safety and Health)
    - 2 independent studies at 2 different locations

- Improvements in dust levels - based on average respirable dust concentrations
  - 35% lower vs. non-wethead in the Return (SIU)
  - 50% lower at the CM operator (CSIR Miningtek)
  - 42% lower at the SC operator (NIOSH)

- Quartz / Silica levels (1 study - NIOSH)
  - 11% lower in the Return
  - 9% lower at the CM operator
  - 66% lower at the SC operator
Projected WetHead Population, 2004-2008

<table>
<thead>
<tr>
<th>Year</th>
<th>Series 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>3</td>
</tr>
<tr>
<td>2006</td>
<td>10</td>
</tr>
<tr>
<td>2007</td>
<td>36</td>
</tr>
<tr>
<td>2008</td>
<td>72</td>
</tr>
</tbody>
</table>
Questions / Comments