JOY GLOBAL INC.

Dust Control on Continuous Mining Machines

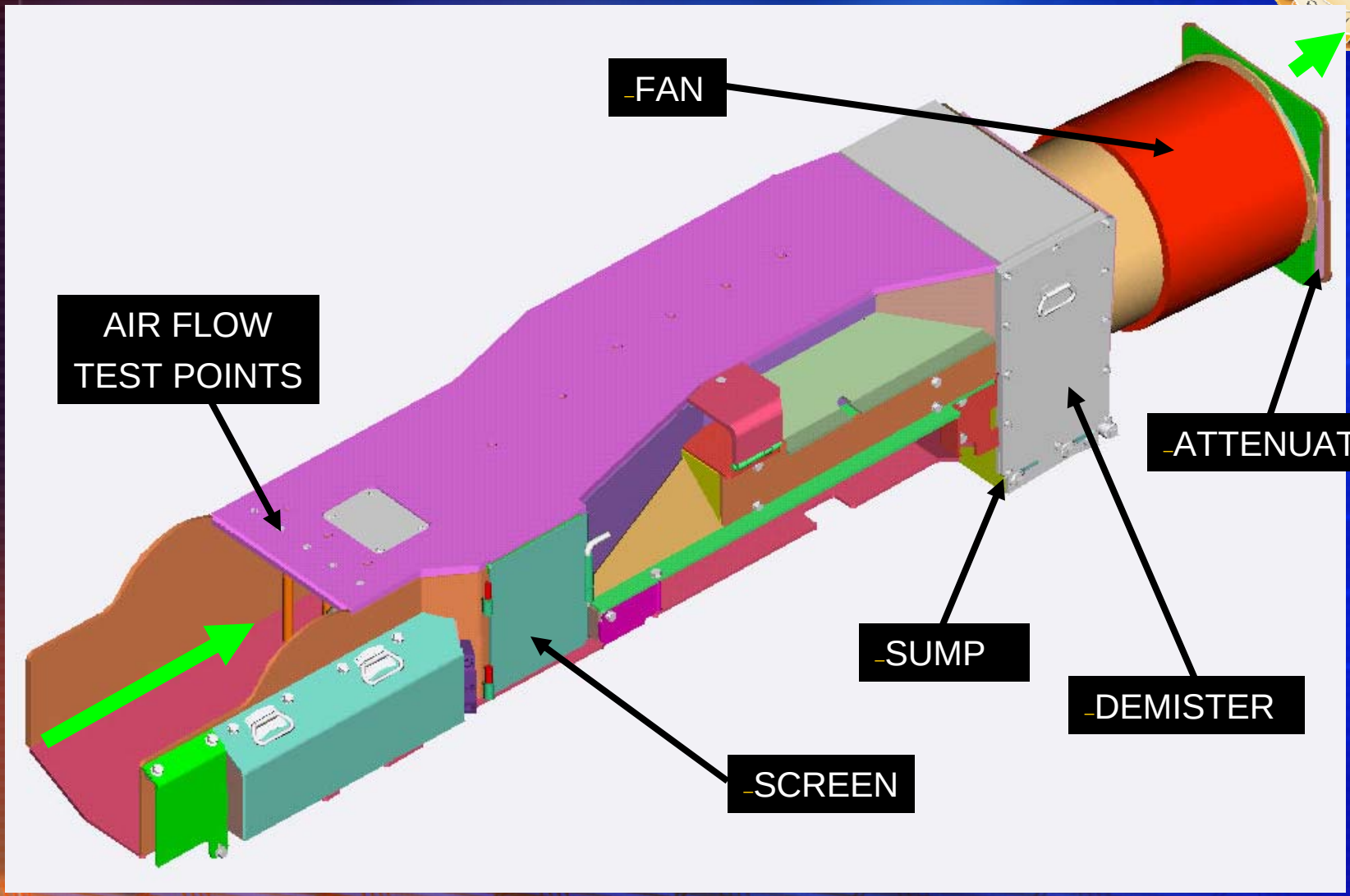
Joy Mining Machinery

Mining New Opportunities

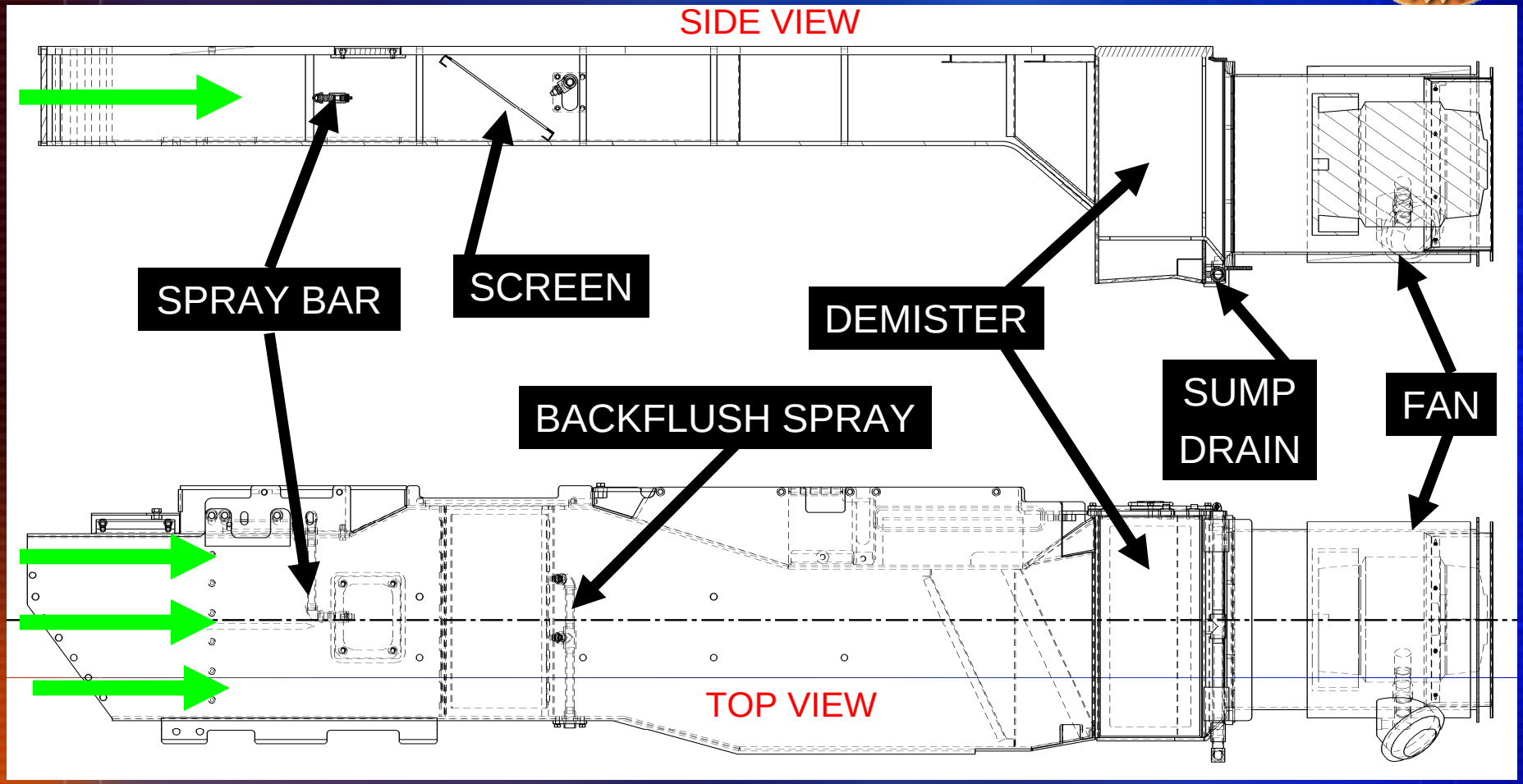
Topics

- Flooded Bed Dust Collector
- Machine Sprays
- Wethead Cutterhead

Flooded Bed Dust Collector



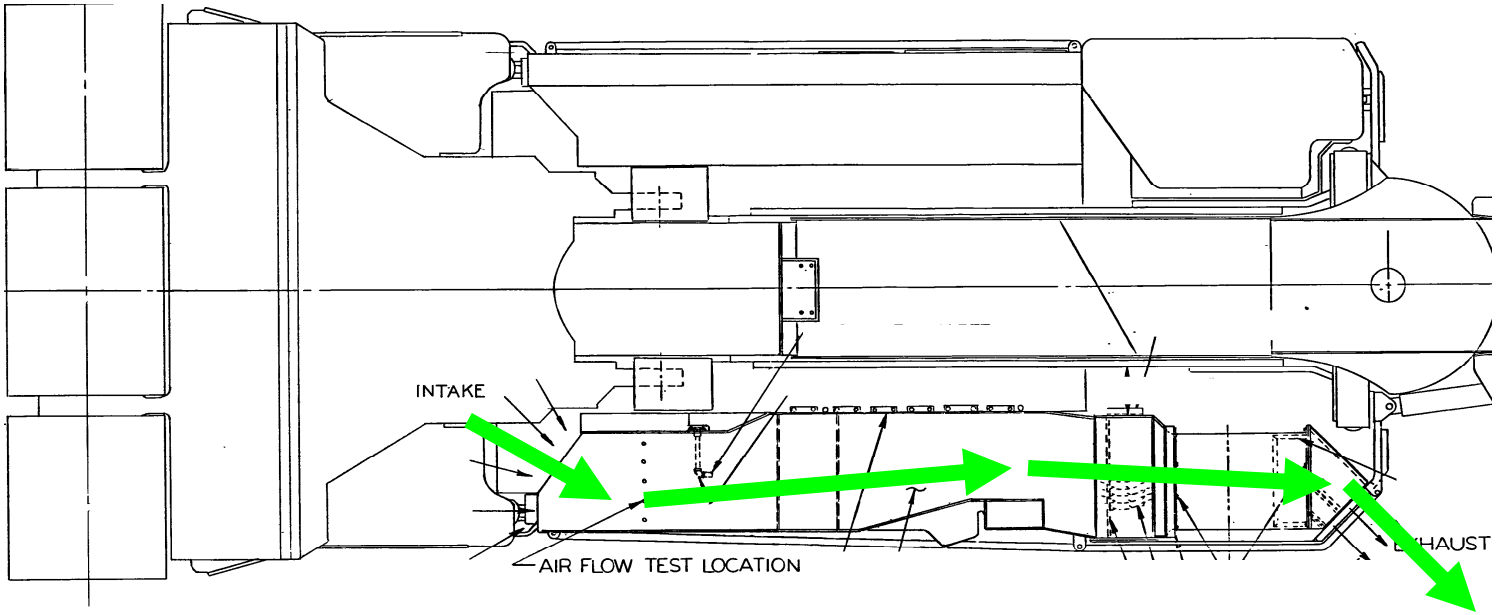
Flooded Bed Dust Collector

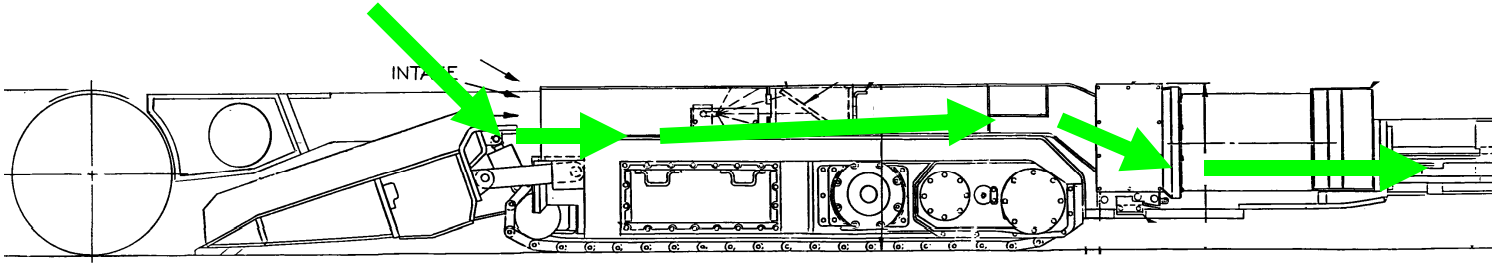


Machine Configuration

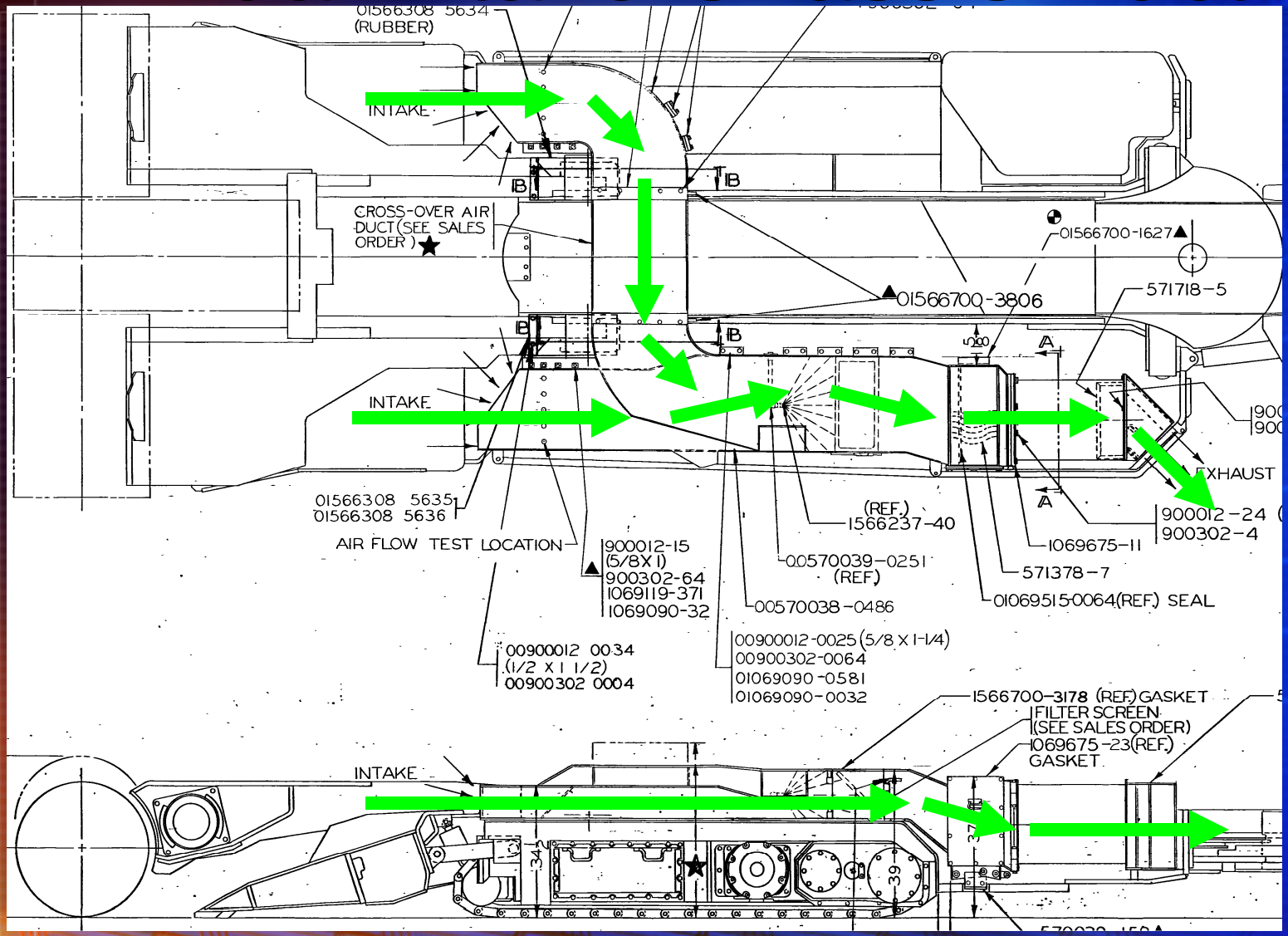
- Intake
  - Chassis Duct Only
  - Dual Intake Chassis Duct
  - Boom Ductwork
- Exhaust
  - Standard
  - Cross Under Duct
- Dual Scrubber

Chassis Duct Only





Dual Intake Chassis Duct



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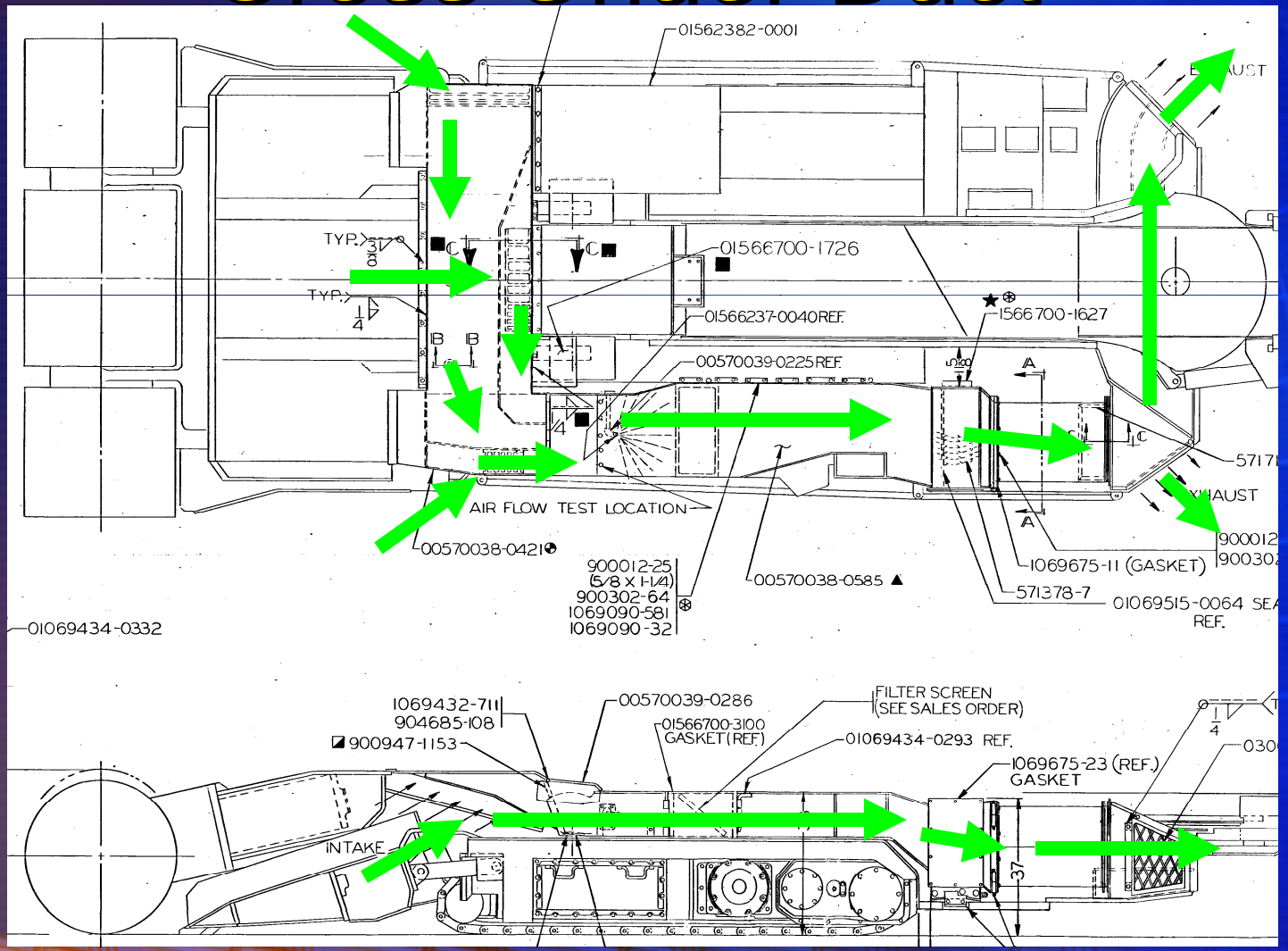
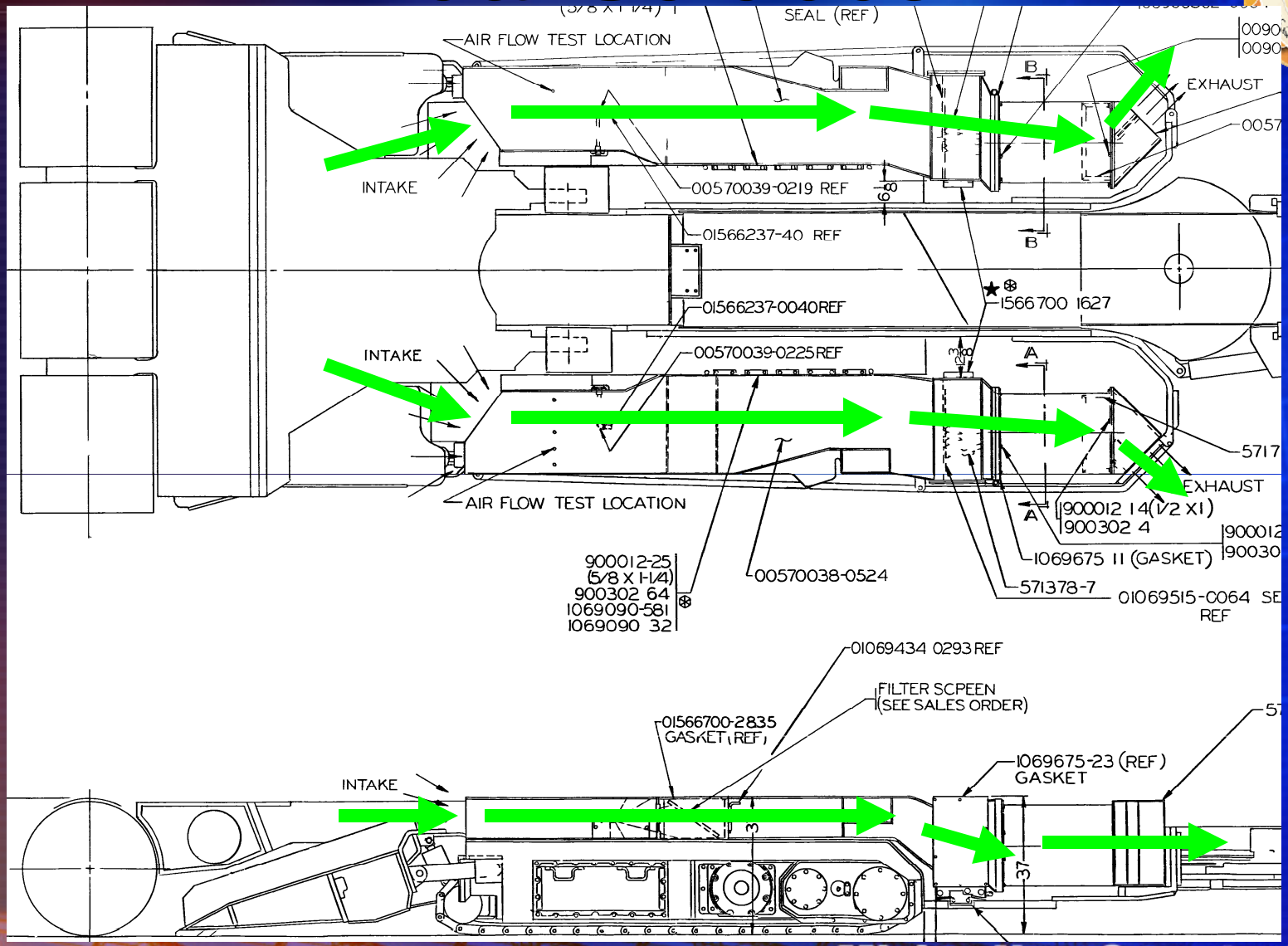
Boom Ductwork w/ Cross Under Duct



Mining New Opportunities

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

Fans

- 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

Boom Duct

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

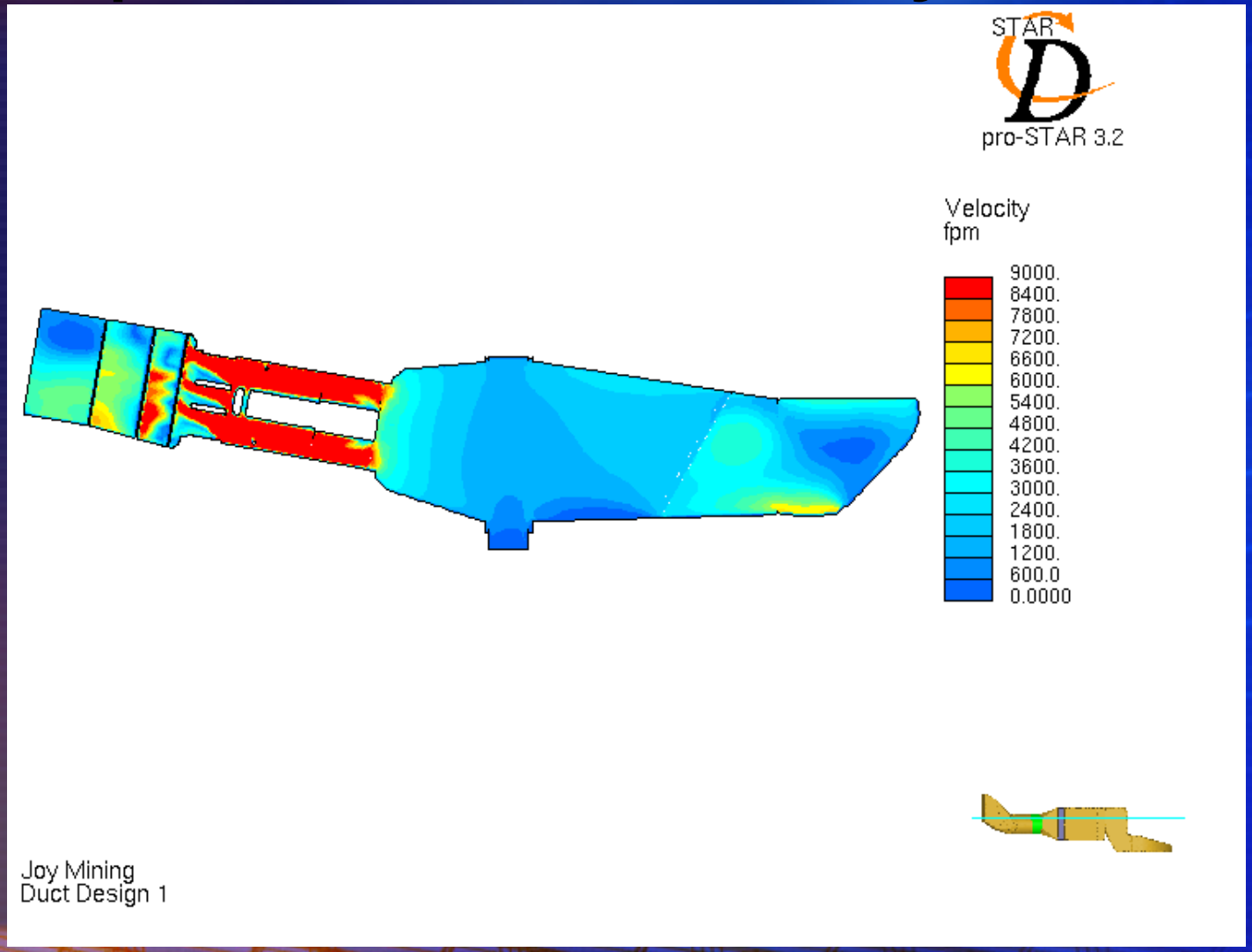
Troubleshooting

- 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 mutlipled by the duct cross sectional area to determine volumetric flow
- The actual volumetric flow is recorded on the demister cover nameplate

Computational Fluid Dynamics



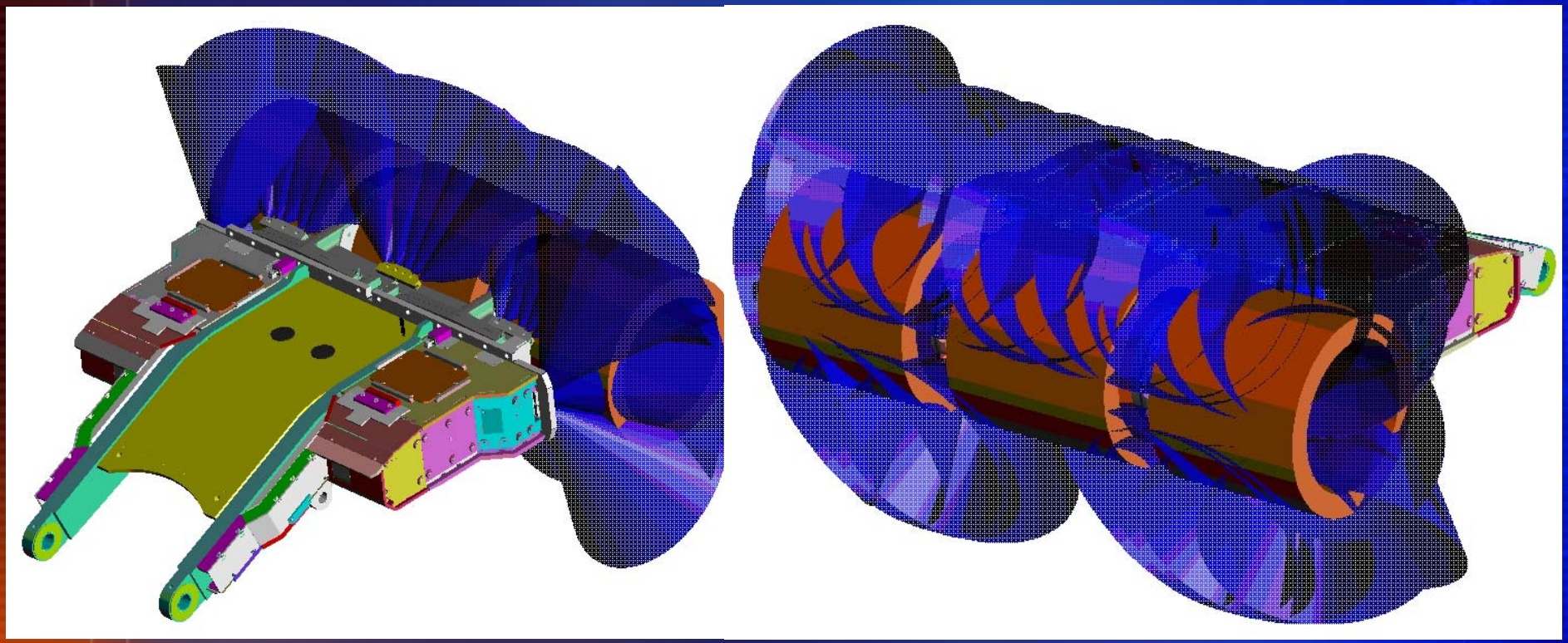
Drawbacks to a FBDC

- 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



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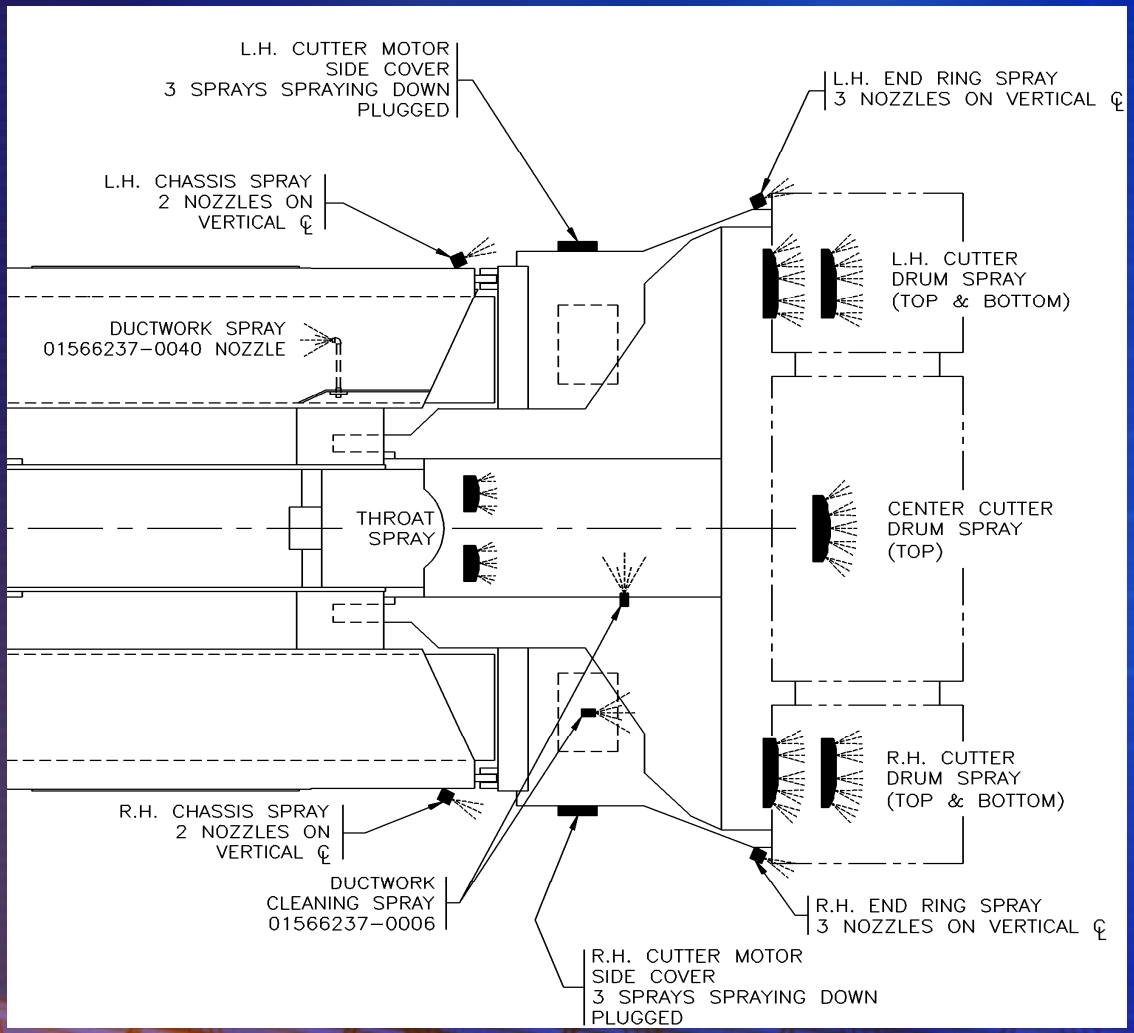
Typical Machine Spray Arrangement



Mining New Opportunities

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The Joy WetHead Cutterhead

44” Cutter Diameter

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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

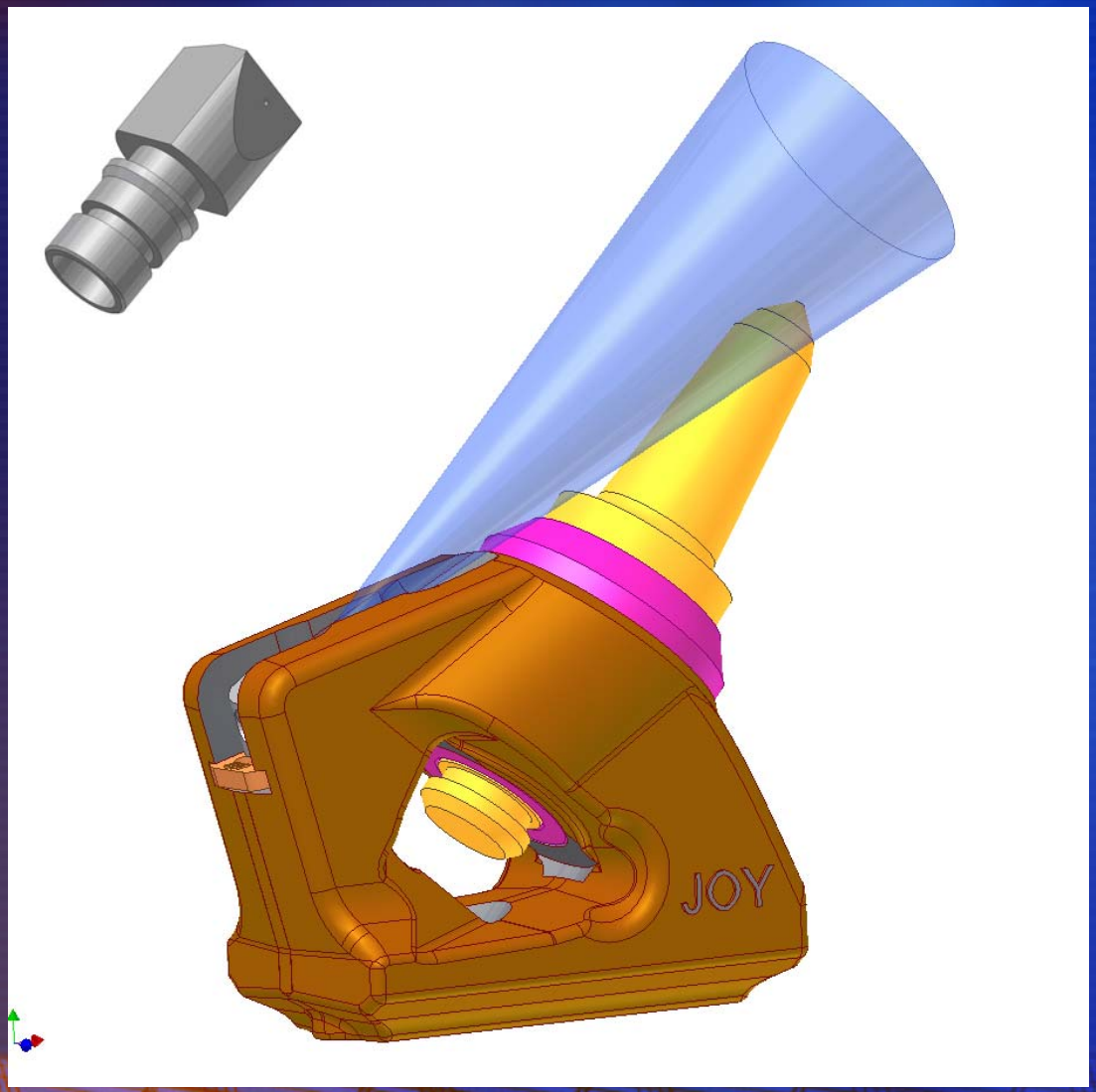
WetHead Features

- **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



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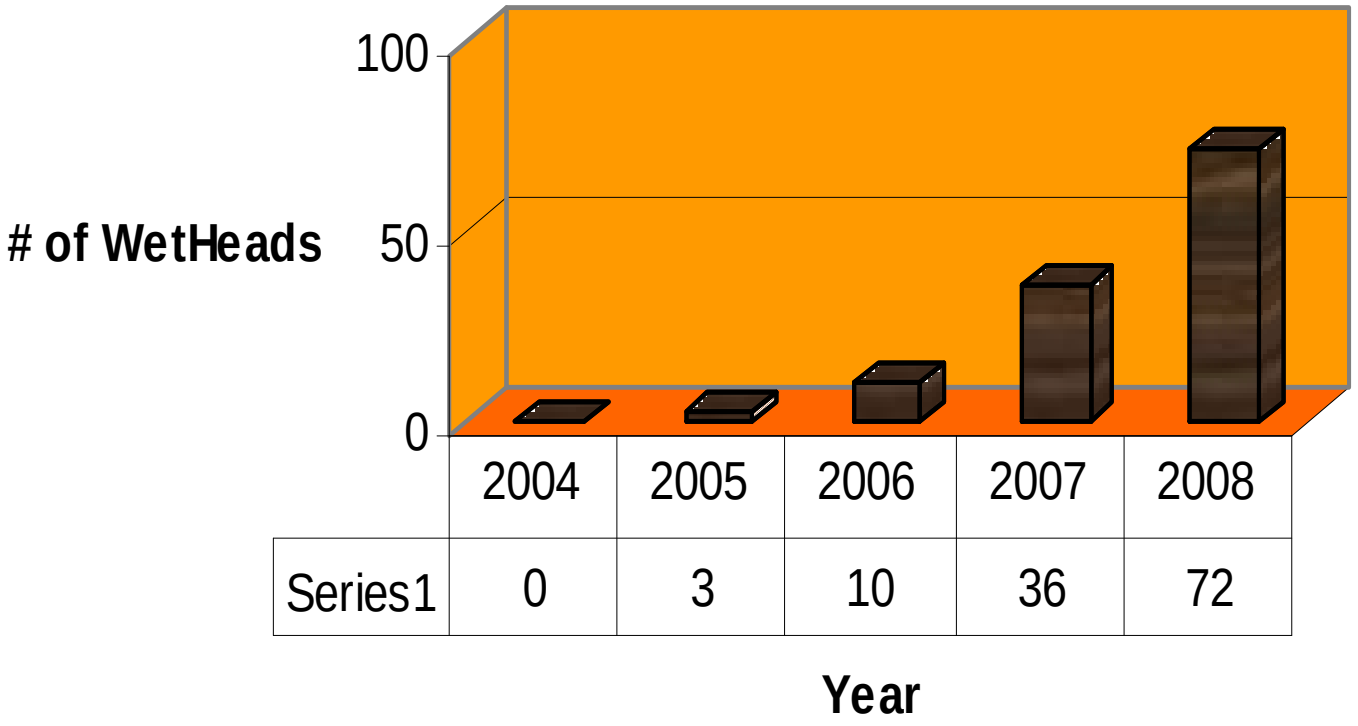
Dust Study Results
(WetHead vs Standard)

- 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

Population Forecast

Projected WetHead Population, 2004-2008



Questions / Comments