GRAVITY CONCENTRATION
Presented by: J.A. Engelbrecht
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CONTENTS
• Normalised Epm and Breakaway Size
• Relative Cut Density Shift
• Coarse particle separation - 100 – 0.5mm
• Economic evaluation
• Fine particle separation - 3 - 0.1mm
• Economic evaluation

Normalised Epm

Figure 1: Partition Curve

Figure 2: Actual EPM Values for Low and High Density Separations

Figure 3: Normalised EPM Values for Low and High Density Separations

Figure 5: Cyclone Efficiency Curves
Relative cut density
D M Cyclones

Normalized Epm and Relative Cut Density – D M Cyclones

Epm vs Size for different dense medium separators

Normalised Epm and Relative Cut Density – Jigs

Normalised Epm vs Particle Size - Cyclones and Jigs

Relative cut density vs Particle Size - Cyclones and Jigs
**Economic Evaluation**

**Near Gravity Material**

![Graph showing the relationship between density and washability for near gravity material.]

**Economic Evaluation**

**Organic Efficiency**

Organic efficiency = Actual Yield / Theoretical Yield

**Washability of 2 Seam Coal**

![Graph showing washability of 2 seam coal.]

**2 Seam Results**

- Dense medium separation gave an increase in yield of 5.5% which equates to a 10.7% increase in production

<table>
<thead>
<tr>
<th>2 Seam Results</th>
<th>Million Tons</th>
<th>Selling Ag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separation Density</td>
<td>1.60</td>
<td>1.65</td>
</tr>
<tr>
<td>Corr. Medium 55%</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>Ash 11%</td>
<td>0.60</td>
<td>0.60</td>
</tr>
<tr>
<td>True Particle Size</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Near Density Material</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>Theoretical Yield</td>
<td>70.92</td>
<td>70.92</td>
</tr>
<tr>
<td>Organic Efficiency</td>
<td>98.11</td>
<td>98.11</td>
</tr>
<tr>
<td>Ash in Final</td>
<td>1.91</td>
<td>1.91</td>
</tr>
<tr>
<td>Fleet's 30%</td>
<td>1.89</td>
<td>1.89</td>
</tr>
<tr>
<td>Total Shipped</td>
<td>8.86</td>
<td>8.86</td>
</tr>
<tr>
<td>Actual Yield</td>
<td>75.11</td>
<td>75.11</td>
</tr>
<tr>
<td>Quality</td>
<td>70.04</td>
<td>70.04</td>
</tr>
</tbody>
</table>

**Partition Curves**

![Graph showing partition curves for 2 seam coal.]

**2 Seam Results**

![Graph showing washability of 2 seam coal.]

**Organic Efficiency**

Organic efficiency = Actual Yield / Theoretical Yield

**Washability of 2 Seam Coal**

![Graph showing washability of 2 seam coal.]

**2 Seam Results**

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**Partition Curves**

![Graph showing partition curves for 2 seam coal.]

**2 Seam Results**

- Dense medium separation gave an increase in yield of 5.5% which equates to a 10.7% increase in production

**Particle Size**

| Particle Size | 7.00 | 7.00 |

**Organic Efficiency**

Organic efficiency = Actual Yield / Theoretical Yield

**Washability of 2 Seam Coal**

![Graph showing washability of 2 seam coal.]

**2 Seam Results**

- Dense medium separation gave an increase in yield of 5.5% which equates to a 10.7% increase in production

**Partition Curves**

![Graph showing partition curves for 2 seam coal.]

**2 Seam Results**

- Dense medium separation gave an increase in yield of 5.5% which equates to a 10.7% increase in production

**Organic Efficiency**

Organic efficiency = Actual Yield / Theoretical Yield
4 Seam results

- Dense medium separation gave an increase in yield of 13% and the increase in production is 59.5%
At a mine site value of R500 per Tonne of coal, the breakeven yield gain is 0.9% for the Dense Medium Plant with the higher running costs compared to a jig plant.

Conclusions
Coarse particles
- Dense medium separation is one of the most efficient processes available in the size range 0.5 – 50 mm
- The cut density shift is less pronounced in dense medium separation
- The running costs of a dense medium plant is higher

Coarse particles
- Dense medium separation is more flexible
- In black and white or very easy separations jigs may be economically viable depending on the percentage near gravity material

Fine Particle Separation
0.1mm – 3 mm

Gravity Separation Equipment in Use
- Spiral Concentrators
- Teetered Bed Separators and Water Only Cyclones
- Fine Dense Medium Cyclones

Fine Dense Medium Cyclones
- Separation to 0 at Homer City and Curragh with 500mm cyclones were inefficient
- Separation at Greenside in 150mm cyclones with a medium of 50% minus 10 micron was difficult with high losses of medium
- Coaltech 20:20 solved the problem with two stage 420mm cyclones using a coarse medium
Conclusions

Fine particle separation
- More significant shift in cut density for TBS
- Spirals cannot achieve cut densities below 1.6
- DMC is still the most efficient process and the most flexible process
- Combinations of equipment will give better overall efficiency. Three examples in the coal industry where the combination of a TBS and Spirals give a better overall result than any individual equipment
- Proper desliming is essential

Financial evaluation

<table>
<thead>
<tr>
<th>100 tph</th>
<th>Capital Costs</th>
<th>Running Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spiral plant</td>
<td>R12 000 000</td>
<td>1.43</td>
</tr>
<tr>
<td>Teetered Bed</td>
<td>R11 600 000</td>
<td>1.32</td>
</tr>
<tr>
<td>Separator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine Dense</td>
<td>R13 200 000</td>
<td>2.94</td>
</tr>
<tr>
<td>Medium Cyclones</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overall Conclusions
- Dense medium separation is the most efficient process as well as the most flexible
- Dense medium separation is the most expensive process
- Combinations of equipment give better overall results in the finer fractions
- The process selection is dependent on the percentage of near gravity material
Overall Conclusions

- The most economic process is dependent on the value in the feed
- The challenge is to design and operate the total system to realise the benefits of the efficiency of dense medium separation

Focus on Value Creation

\[
\text{Value} = \text{Function} \times \text{Cost}
\]

From a mining industry point of view the function will include:
- Throughput
- Quality consistency
- Resource utilization (Maximum Coal Production)

The cost to achieve the required function will include:
- CAPEX (Capital investment)
- OPEX (Cost to maintain the equipment and operation)

### Table - Scenario 1 vs Scenario 2

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Tons</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Product</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Recovery</td>
<td>85%</td>
<td>85%</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1,121,000</td>
<td>$1,400,000</td>
</tr>
<tr>
<td>Difference per hour</td>
<td>$279,000</td>
<td></td>
</tr>
<tr>
<td>Operating Hours</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Difference per year</td>
<td>$2,232,000</td>
<td></td>
</tr>
</tbody>
</table>
**Washability**

Near Density

Defined as:

The % (D_x) of NEAR DENSITY material which lies within ±0.1 RD intervals on either side of the Separation Density.

(New standard +/- 0.05)

<table>
<thead>
<tr>
<th>D_x, %</th>
<th>Degree of Difficulty</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 7</td>
<td>Simple</td>
</tr>
<tr>
<td>7 – 10</td>
<td>Moderate Difficult</td>
</tr>
<tr>
<td>10 – 15</td>
<td>Difficult</td>
</tr>
<tr>
<td>15 – 20</td>
<td>Very Difficult</td>
</tr>
<tr>
<td>&gt; 25</td>
<td>Exceedingly Difficult</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>Formidable</td>
</tr>
</tbody>
</table>

![Graph: Near Yield vs Relative Density](image)
Gondwanaland Coals

Increase in Cut density = Increase in EP value

Effect of Poor Efficiency

Different Coal Sources = Different Approaches / Recommendations

Contents

- DMC Process
- Washability
- Dense Medium Cyclones
  - Cyclone Operation
  - Cyclone Design
  - Performance Constraints
- DMC Factors
- Operational Parameters
- Cyclone selection
- Fault Finding
- Maintenance
Cyclone Dimensions: DSM vs. Multotec

**Cyclone Design**

**Cyclone Dimensions: DSM vs. Multotec**

<table>
<thead>
<tr>
<th>Cyclone type</th>
<th>DSM</th>
<th>Multotec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter (D)</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>Inlet</td>
<td>0.2xD-Tangential</td>
<td>0.2xD, 0.25xD, 0.3xD – Evolute and Scrolled Evolute</td>
</tr>
<tr>
<td>Cone Angle</td>
<td>20 Degrees</td>
<td>20 Degrees</td>
</tr>
<tr>
<td>Vortex finder</td>
<td>0.43xD</td>
<td>0.43xD, 0.5xD</td>
</tr>
<tr>
<td>Spigot</td>
<td>0.7xVF</td>
<td>0.7xVF, 0.8xVF</td>
</tr>
<tr>
<td>Barrel</td>
<td>Seldom used</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Effect of Cyclone Configuration**

- **B Type Inlet**
  - As the Inlet Size Increases
  - Cyclone Capacity Increases
  - Efficiency Decreases

- **A Type Inlet**
  - As the Vortex Finder Increases
  - Cyclone Capacity Increases
  - Efficiency Decreases
  - Larger Spigot Available (0.8 x VF)

- **No Barrel**
  - With the inclusion of a Barrel:
    - Cyclone Length Increases
    - Cyclone Capacity Increases
    - Efficiency Increases
**Contents**

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**Performance Constraints**

**A DMS Cyclone is sized with reference to three Criteria**

The size of cyclone selected will be the largest needed to satisfy all three of the following:

1. Volumetric Capacity
2. Top and Bottom Size
3. Spigot Capacity (Size)

---

**Cyclone Constraints – Volumetric Capacity**

<table>
<thead>
<tr>
<th>STREAM</th>
<th>M:O RATIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEED</td>
<td>≥ 3</td>
</tr>
<tr>
<td>OVERFLOW</td>
<td>≥ 2.5</td>
</tr>
<tr>
<td>UNDERFLOW</td>
<td>≥ 1.5</td>
</tr>
</tbody>
</table>

**Cyclone Constraints – Top and Bottom Size**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEED</td>
<td>0.33 x D, int. = D_{min}</td>
</tr>
<tr>
<td>HANGUP SIZE</td>
<td>0.7xD_{max}, (?)</td>
</tr>
<tr>
<td>BREAKAWAY SIZE</td>
<td>See Graph</td>
</tr>
</tbody>
</table>

---

**Cyclone Constraints – Volumetric Capacity**

![Graph of M:O Ratio](image)
**Performance Constraints**

Cyclone Constraints – Top and Bottom Size

- **Breakaway Size (mm)**
  - 6.00
  - 7.00
  - 9.00

- **30.0**
- **40.0**
- **60.0**

**FIGURE 12**

- **Particle Size (mm)**
  - 0.04
  - 0.05
  - 0.06
  - 0.07
  - 0.08

- **0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10**

**Cyclone Efficiency Curves**

- **Recommended Size Distribution Limits**

**Cyclone Constraints – Top and Bottom Size**

- Large particles require large diameter cyclones which requires large volumes
- If solids feed rate is low then alternative equipment must be considered

**Volumetric split to underflow**

- If solids feed rate is low then alternative equipment must be considered

**High solids feed rate require large cyclone diameters**

- If mass grading is very fine, multiple smaller diameter cyclones must be considered

**Performance Constraints**
Performance Constraints
Cyclone Constraints – Spigot Capacity (Size)

- Normal Spigot = 0.7 x VF
- High Capacity Spigot = 0.8 x VF

Spigot size determined by mass recovery to underflow
Once selected, spigot: vortex finder ratio needs to be checked
Spigot diameter also affects differentials

Performance Constraints
Cyclone Constraints – Spigot Capacity (Size)

Underflow Capacity
- M:O Ratio ≥ 1.5
- Volumetric Split = F(D_u/D_o)
- Maximum D_u/D_o = 0.8

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DMC Factors
Normalised Epm

Figure 2: Actual EPM Values for Low and High Density Separations

Figure 3: Normalised EPM Values for Low and High Density Separations

Figure 5: Cyclone Efficiency Curves
Figure 6: Particle Size vs Relative Cut Density

Figure 7: Particle Size vs Normalised EPM and Relative Cut Density

Contents
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  - Maintenance
  - Conclusions
Operational Parameters

A particle "hang-up" or retention size exist

The "hang-up" size is a function of:

- Cyclone diameter
- Spigot size
- Particle density
Operational Parameters

Hang-Up

If differentials are too big, hang-up of particles can occur

• Surges on the reject drain and rinse screen should alarm the operator to investigate the spigot discharge on the cyclone
• Severe surging may lead to yield losses and should be corrected ASAP
• Quickest fix for specific feed coal type is normally a slight decrease in CM density if product ash values allows it

Operational Parameters

Density Control

Factors Affecting Cut Density
- Medium stability (Dilute circuit losses)
- Operating pressure (Pump wear)
- Cyclone size and configuration
- Spigot size (Wear)

In order for parallel cyclones or modules to have the same cut densities the following is required:
- Cyclone dimensions must be equal
- Medium properties must be the same
- Pressure must be equal
- Feed rate must be equal
- Surface moisture must be equal
- Distribution must be equal
When selecting DM Cyclones be careful:

- To only base the selection on the smallest cyclone with the highest capacity (Efficiency)
- Note important maintenance issues (Eff)
- Consider all the coal feed types (statistical view, especially on yield expectations and spigot overload conditions)

• One should consider the following:
  - Feed rate (solids)
  - Medium to Ore Ratio (Feed, OF & UF)
  - Top Size in the feed
  - Feed Particle Size Distribution
  - Yield to Product
  - Spigot capacity
- Example
  - Feed tonnage = 200 t/h
  - Feed Solids density = 1.4 t/m³
  - Top size = 50 mm
  - Yield = 60% to product
  - Sinks density = 1.55 t/m³

### Cyclone Selection

**Feed Particle Size Distribution**

<table>
<thead>
<tr>
<th>Upper</th>
<th>Lower</th>
<th>Midpoint</th>
<th>% Fractional</th>
<th>% Cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.00</td>
<td>16.00</td>
<td>16.00</td>
<td>26.60</td>
<td>56.60</td>
</tr>
<tr>
<td>16.00</td>
<td>16.00</td>
<td>16.00</td>
<td>26.60</td>
<td>56.60</td>
</tr>
<tr>
<td>16.00</td>
<td>16.00</td>
<td>16.00</td>
<td>26.60</td>
<td>56.60</td>
</tr>
<tr>
<td>16.00</td>
<td>16.00</td>
<td>16.00</td>
<td>26.60</td>
<td>56.60</td>
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<tr>
<td>16.00</td>
<td>16.00</td>
<td>16.00</td>
<td>26.60</td>
<td>56.60</td>
</tr>
<tr>
<td>16.00</td>
<td>16.00</td>
<td>16.00</td>
<td>26.60</td>
<td>56.60</td>
</tr>
</tbody>
</table>

- Example
  - Calculate coal balance around cyclone
  - Feed = 200 tph (143 m³/h)
  - Floats = 200 x 0.60 = 120 tph
  - Sinks = 200 x 0.90 = 80 tph (52 m³/h)

### Cyclone Selection

- Example
  - Do initial selection on medium to Coal ratio
  - Minimum ratio for coal is 3.0 to 1.0
  - Medium volume = 3.0 x 143 = 429 m³/h
  - Pulp volume required = 572 m³/h
Cyclone Selection

- Operating pressure
  - 900 mm cyclone @ 10D head
  - Head = 10 x 900 mm = 9.0m
  - Medium density = 1.3 SG
  - Pressure = medium SG x g x H(m)
  - Pressure = 1.3 x 9.81 x 9.0 m = 115 kPa

Cyclone Selection

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- Fault Finding
- Maintenance
- Conclusions

Fault Finding
Fault Finding

- A list of factors, which can affect cyclone performance, follows:
  - Size of cyclone
  - Size of spigot
  - Design of cyclone
  - Steps or grooves inside cyclone
  - Feed rate
  - Yield
  - Media stability and viscosity (% non-magnetics, slimes, PSD of medium solids)
  - Particle size distribution of feed ore
  - Operating head (Constant / Stable?)
  - Density control (Constant / Stable?)
  - Sampling and analyses errors

Contents

- DMC Process
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Maintenance

- Oversize spigot

- Welding

- Effect of a hammer
Maintenance
- Quality of workmanship

Maintenance
- Tramp Metal

Maintenance
- Cyclone Vortex Finder

Maintenance
- DMS Cyclone Spigot

Classification Cyclones
- Purpose
- Factors affecting performance
- Impact of poor efficiency
- Operational Parameters
- Fault Finding
- Inspection
- Good Practice
Purpose

Classify
• Separate into different size fractions
• Cyclone diameter as large as 900mm diameter
• Cut point: 50µm – 200µm

Purpose

Desliming
• Remove ultra fine size fractions
• Cyclone diameter generally small – 75mm to 165mm
• Cut point : 10µm – 20µm

Purpose

Dewatering
• Remove as much water possible
• Cyclone diameter generally small – 250mm to 500mm
• Cut point : 40µm – 70µm

Factors affecting Performance

Factors affecting D50c

- Cyclone diameter
- Cyclone vortex diameter
- Fluid solids concentration
- Spigot diameter
- Operating pressure
Factors affecting Performance

- Factors affecting Imperfection

![Graph showing solids concentration, operating pressure, and residence time as factors affecting imperfection.]

Factors affecting Performance

- Purpose
- Factors affecting performance
- Impact of poor efficiency
- Operational Parameters
- Fault Finding
- Inspection
- Good Practice

Impact of Poor Efficiency

- Downstream effect - Spirals

Impact of Poor Efficiency

- Downstream effect - Flotation

![Graph showing the impact of downstream effect on Spirals and Flotation.]
Operational Parameters

- Volumetric flow rate – determines operational pressure
- Mass flow rate (screen panel wear) – influences spigot loading and solids feed concentration
- Feed size distribution (screen panel changes) – influences mass split

Fault Finding

- Surging
- Misplacement of fine material
- Misplacement of coarse material
- Too low or high operating pressure

Inspection

- Underflow discharge pattern
- Pressure gauge readings
- % Oversize in cyclone overflow
- Pulp densities of cyclone feed, overflow and underflow

Cyclone Underflow Discharge
Inspection

- Pressure gauge readings
- % Oversize in cyclone overflow
- Pulp densities of cyclone feed, overflow and underflow

- Cyclone Cone
- Cyclone Spigot
- Cyclone Vortex Finder

Purpose
- Factors affecting performance
- Impact of poor efficiency
- Operational Parameters
- Fault Finding
- Inspection
- Good Practice
Good Practice

- Constant solids feed rate to minimize roping
- Constant volumetric flow rate to minimize fluctuating pressures / Adequate operating pressures
- Regular inspections – cyclones and screen panels
- Proper access for sampling

Coal Spirals

Spirals in a Coal Prep Flow Sheet

- Generally treat 1.0 x 0.1 mm (16 x 150 Mesh)
- Allow heavy media cyclones to clean down to 1 mm—more efficient desliming and media recovery
- Allow froth flotation to clean minus 0.1 mm (150 mesh)—better flotation of finer particles

Fine coal (-1 mm): Up to 20% of ROM

<table>
<thead>
<tr>
<th>EFFICIENCY PERCENT</th>
<th>SIZE IN MICRONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>10000</td>
</tr>
<tr>
<td>80</td>
<td>10000</td>
</tr>
<tr>
<td>60</td>
<td>10000</td>
</tr>
<tr>
<td>40</td>
<td>10000</td>
</tr>
<tr>
<td>20</td>
<td>10000</td>
</tr>
</tbody>
</table>

Spiral Concentrators
- How do they work?
- Who needs them?
- Why particles separate
- Separation criteria
- Factors affecting performance
- Single vs. Double stage spirals
- Effect of slimes
- Spirals vs. TBS
- General Problems
- What not to do
Spirals are:
- very forgiving nature,
- tolerate wide range of feed tonnages,
- low cost to purchase & operate,
- Easy adjust and relatively good performance.

What are Spiral Concentrators?
- Uses differences in mineral densities to separate them
- As minerals flow through concentrator, they segregate along the trough
- Large diameter spirals
- Small diameter spirals

How do they work?
- Process equipment
- No moving parts
- Used to separate valuable from non valuable minerals

Who needs them?
- Used in several sectors within the minerals processing industry including:
  - Coal
  - Heavy Minerals
  - Chromite
  - Tin/Tantalite
  - Base metals
  - Gold
  - Iron Ore

What not to do
Why particles separate

- Gravity separation utilising spiral concentrators is not only dependent on the differential between particle specific gravity, but various other mineral characteristics such as:
  - Particle size
  - Shape
  - Porosity
  - Mineral content

<table>
<thead>
<tr>
<th>Separation</th>
<th>Ratio</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>2.0</td>
<td>Mineral Sands</td>
</tr>
<tr>
<td>Good</td>
<td>1.5</td>
<td>Coal</td>
</tr>
<tr>
<td>Poor</td>
<td>1.1</td>
<td>Diamonds</td>
</tr>
</tbody>
</table>

Factors affecting Performance

- Single vs. Double stage spirals
  - Spirals in a Coal Prep Flow Sheet
  - What are Spiral Concentrators?
  - How do they work?
  - Who needs them?
  - Why particles separate
  - Separation criteria
  - Factors affecting performance
  - Single vs. Double stage spirals
    - Effect of slimes
    - Spirals vs. TBS
    - General Problems
    - What not to do

- Check feed to spirals:
  - Factors that affect the feed
    - Slimes content
    - Size distribution
    - Percent solids
    - Grade
    - Mineral
    - Tonnage
    - Volumetric flow
**Single vs. Double Stage Spirals**
- Two-in-one coal spirals
  - savings in space
  - pumps
  - sumps
  - power and piping
- results in a very quick payback

**Effect of Slimes**
- Deslime cyclones ahead of the spirals radically improved the performance of the spirals.

**Spirals vs. TBS**
- Results showed the equipment range links to size range
- Spirals best between 800 and 100 micron
- TBS better over coarser range

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**Cut Density vs Particle Size**

<table>
<thead>
<tr>
<th>Density</th>
<th>Particle Size (µm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>1.60</td>
<td></td>
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<tr>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>1.80</td>
<td></td>
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<tr>
<td>1.90</td>
<td></td>
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<tr>
<td>2.00</td>
<td></td>
</tr>
<tr>
<td>2.10</td>
<td></td>
</tr>
</tbody>
</table>

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**Flow Sheet 1**

**Flow Sheet 2**
General Problems

We must understand that spirals are:
- Static pieces of equipment
- Have no moving parts – splitters only
- They cannot think or move without outside intervention
- Very often neglected in a plant

General Problems

If the spiral plant is not producing the goods, it is due to:
- Poor plant design
- Deterioration of the spirals or equipment
- Changes to feed conditions
- Plant changes
- Ignore or neglect operating conditions

General Problems

Two areas affected when problems:
- Production related
- Operation related

General Problems

Production Related:
- Loss in yield and quality of final product due to under washing on other processes to maintain product quality
- Off spec product produced to get yield
- Results in loss of revenue

General Problems

Operation Related:
- Blockages
- Deterioration of the spirals
- Incorrect pipes in launders
- Incorrect feed conditions
- Overflowing slurry
- Leak in pipes and launders
- Worn spirals
Areas to look out for:

- Distribution of slurry
- Feed conditions
- Spiral and equipment condition

• Spirals in a Coal Prep Flow Sheet
• What are Spiral Concentrators?
• How do they work?
• Who needs them?
• Why particles separate
• Separation criteria
• Factors affecting performance
• Single vs. Double stage spirals
• Effect of slimes
• Spirals vs. TBS
• General Problems
  • What not to do

Incorrect Piping

Incorrect Piping
Incorrect Piping

Pump surge – too high volume

Too high volume

Worn troughs

Beaching

Spirals used as ladders
Spillage – overflowing launders

Water addition in wrong place

Water addition in wrong place

Material buildup

Thank You