The Basics of Screening

Joe Schlabach, VP of Marketing & Sales

WHAT IS A VIBRATING SCREEN?
WHAT IS A VIBRATING SCREEN?

• A machine tool to separate aggregates by particle size by means of an exciting force applied to the machine causing it to vibrate.
IT IS A MACHINE USED TO:

- Separate aggregates
- Wash aggregates
HOW DOES IT SEPARATE?
• It agitates the material causing the material to stratify allowing the smaller material to fall through the openings of the screening surface.
HOW DOES IT WASH?
HOW DOES IT WASH?

• By adding water during the agitation process.

TYPES OF VIBRATING SCREENS
INCLINED SCREEN

HORIZONTAL SCREEN
TRIPLE-SHAFTED HORIZONTAL SCREEN

HIGH SPEED
DEWATERING

QUALITY AND CONSISTENCY

• Determined by:
  – Proper Screen Selection
INCLINED SCREENS

HORIZONTAL SCREEN
QUALITY AND CONSISTENCY

• Determined by:
  – Proper Screen Selection
  – Proper Operating Parameters

OPERATING PARAMETERS

To effectively separate the materials, the proper operating parameters are applied to the vibrating screen.

• Speed
• Stroke
• Direction of rotation
• Angle of inclination
Advantages in Increase Speed

- Increase screen carrying capacity
- Increase material acceleration
- Increase material travel rate

Disadvantages in Increase Speed

- Increase screen operating stresses
- Decrease bearing life
- Possibility of operating at a critical frequency

Screen Strokes

- Circular Motion
- Straight Line Motion
How can you measure stroke?

STROKE

LEFT DISCHARGE END
How can you change the stroke?

External Counterweight
Internal Counterweights

Advantages in Increase Stroke

- Increase screen carrying capacity
- Increase material acceleration
- Increase material travel rate
- Reduce plugging and blinding
- Improve material stratification

Disadvantages in Increase Stroke

- Increase screen operating stresses
- Decrease bearing life
- May cause inefficiency due to bouncing
SCREEN SETUP

COARSE SEPARATION

LOW SPEED AND LARGE STROKE

FINE SEPARATION

HIGH SPEED AND SMALL STROKE

G-Force Formula

\[
G\text{-FORCE} = 0.051 \times \frac{(\text{REVOLUTIONS PER MINUTE})^2 \times \text{THROW IN INCHES} \quad \text{OR} \quad (\text{RPM}^2 \times \text{THROW})}{70418}
\]
G-Force Example

Setup #1
Stroke 0.38 Inches
Speed 850 RPM
G Force 3.85

Setup #2
Stroke 0.38 Inches
Speed 935 RPM
G Force 4.66
% Increase 21%

Setup #3
Stroke 0.41 Inches
Speed 850 RPM
G Force 4.23
% Increase 10%

DETERMINING FACTORS

• Feed volume (TPH)
• Size of deck openings
• Largest particle size
• Particle shape
DETERMINING FACTORS

- Feed volume (TPH)
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- Type of screen media
- Size and type of machine
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DETERMINING FACTORS

- Feed volume (TPH)
- Size of deck openings
- Largest particle size
- Particle shape

- Type of screen media
- Size and type of machine
- Size of screen bearings
- Wet or dry screening
QUALITY AND CONSISTENCY

• Determined by:
  – Proper Screen Selection
  – Proper Operating Parameters
  – Proper Screening Media

SCREEN MEDIA

• Screen Cloth
• Screen Plate
• Polyurethane Screens
• Rubber Screens
SCREEN MEDIA

- Screen Cloth with:
  - Square openings
  - Rectangular openings
  - Slotted openings
  - Zig-Zag openings
  - Proper Wire Diameter
  - Proper Grade of Wire

SCREEN EFFICIENCY

Efficiency =

\[
\text{Efficiency} = \frac{\% \text{ undersize in feed that actually passes an opening}}{\% \text{ undersize in feed}}
\]
Screen Efficiency

<table>
<thead>
<tr>
<th></th>
<th>Feed</th>
<th>Oversize</th>
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<tbody>
<tr>
<td>TPH</td>
<td>860</td>
<td>382</td>
</tr>
<tr>
<td>3&quot;</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>2&quot;</td>
<td>94.4</td>
<td>87.3</td>
</tr>
<tr>
<td>1 1/2&quot;</td>
<td>83.6</td>
<td>63.1</td>
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<tr>
<td>1 1/4&quot;</td>
<td>73.2</td>
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<tr>
<td>1&quot;</td>
<td>64.3</td>
<td>30.2</td>
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<tr>
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<td>52.3</td>
<td>20.2</td>
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<td>1/2&quot;</td>
<td>32.5</td>
<td>8.4</td>
</tr>
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<td>22.5</td>
<td>4.3</td>
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<tr>
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<td>13.5</td>
<td>1.6</td>
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</tbody>
</table>

Calculating Screen Efficiency

Step #1 – Calculate oversize in feed

860 TPH Feed x 73% passing 1 ¼" = 630 TPH undersize in feed

Step #2 – Calculate TPH undersize in deck oversize

382 TPH Oversize x 40% passing 1 ¼" = 152 TPH undersize in overs

Step #3 – Calculate TPH undersize that passes the deck

630 TPH – 152 TPH = 477 TPH undersize that passes deck

Step #4 – Calculate Efficiency

477 TPH / 630 TPH = .76 or 76% Efficient
Screen Efficiency Problem

\[ \text{Screen Capacity Formula} \]

\[ T = \frac{S}{A \times B \times C \times D \times E \times F} \]

- **S** = Screening Area
- **T** = Tonnage Through the Deck
- **A** = Capacity in TPH Per Square Foot
- **B** = % of Oversize in feed Per Deck
- **C** = Desired Efficiency
- **D** = % of Feed less than Half Size Per Deck
- **E** = Wet Factor
- **F** = Deck Factor
Depth of Bed Formula

\[ D = \frac{T \times K}{5 \times S \times W} \]

D = Depth of Material in Inches
T = TPH Over Screen Deck
K = Number of Cubic Feet per Ton of Material
S = 70 FPM
W = Net Width of Screen in Feet (nominal width - 6”) 

Affect of Water on Capacity

<table>
<thead>
<tr>
<th>Size of Opening</th>
<th>Factor E</th>
</tr>
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<tbody>
<tr>
<td>1/32”</td>
<td>1.25</td>
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<tr>
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<tr>
<td>3/16”</td>
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<tr>
<td>5/16”</td>
<td>1.75</td>
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<td>3/8”</td>
<td>1.50</td>
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<tr>
<td>1/2”</td>
<td>1.30</td>
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<tr>
<td>3/4”</td>
<td>1.20</td>
</tr>
<tr>
<td>1”</td>
<td>1.10</td>
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</table>
Screen Feed

• What is the proper way to feed a screen?

Typical Feed Box Arrangement
Typical Feed Box Arrangement

Diagram showing the flow of materials through a feed box with labels indicating various stages and components.
APPLICATION PROBLEMS

- **Plugging**
  - Near size particles which become lodged in the openings blocking the openings

**Material Plugging**
APPLICATION PROBLEMS

- **Plugging**
  - Near size particles which become lodged in the openings blocking the openings

- **Blinding**
  - Fine particles which stick to the surface media due to moisture gradually blanking over the openings
Material Blinding
APPLICATION PROBLEMS

• Plugging
  – Near size particles which become lodged in the openings blocking the openings
• Blinding
  – Fine particles which stick to the surface media due to moisture gradually blanking over the openings
• Carryover or dirty material
  – Excessive undersize particles failing to pass through the openings

PLUGGING SOLUTIONS

• More stroke
• Smaller wire diameter
• Change hole shape (slotted or rectangular openings)
• Different surface media
• Adjust crusher setting
BLINDING SOLUTIONS

• Increase speed
• Change stroke
• Smaller wire diameter
• Different surface media
• Ball trays
• Heated decks
• Add water

CARRYOVER SOLUTIONS

• Change stroke
• Change speed
• Reverse screen rotation
• Change wire diameter or shape of opening to increase open area
• Change angle of inclination
• Feed centered on the screen
• Control feed segregation
• Change feed tonnage
DEISTER MACHINE CO., INC.

Joe Schlabach
260-426-7495
www.deistermachine.com