Vibratory Screen Cleaning Methods Improve Screening Efficiencies and Save Money

By Greg Brock

INTRODUCTION

Screen blinding occurs when the screen mesh openings are blocked or closed by the material which is being screened. Near size particles become trapped or build up on the wires effectively blocking the screen openings preventing further material from passing through the screen. This is a common screening problem which is easily fixed with screen cleaning devices. This article will review the most common methods of screen deblinding.

SCREEN CLEANING DEVICES

SLIDERS
The most common self cleaning device is the “SLIDER”. Slider Rings are loose rings which slide directly beneath the screen surface on a slider support surface, normally a perforated metal plate. The rings are bounced vertically into the screen mesh by the vertical motion of the separator as they travel radially around the screen. The sliders are activated by the motion of the separator without additional driving force.
Sliders travel across the top of a perforated plate. The motion of the vibratory separator throws the sliders into the screen as they rotate around the center of the machine.

Sliders are especially good on fine mesh because of the low impact energy and the shearing wiping action which cleans the screen openings. Sliders can be used in both wet and dry screening applications.

Sliders work by four different methods depending on the material properties.

1- Vertical separator motion impacts the slider ring on the bottom of the mesh dislodging trapped near size particles out of the screen mesh openings effectively cleaning the screen and opening the mesh for the next particle to be screened.

2- The slider shears or breaks protruding hard or friable materials into smaller pieces which flow through the screen clearing the openings.

3- If the material is soft and pliable, the sliders can help the material through the screen openings.

4- If the material is fibrous, the sliders horizontal scrubbing motion across the bottom of the screen will dislodge trapped fibers from the screen openings improving throughput capacity.

Sliders are not efficient for materials which tend to ball up or agglomerate inside the sliders. Sliders also generate minor amounts of heat which can fuse temperature sensitive
materials. Sliders may not perform well on extremely hard irregular shaped materials which can partially protrude through the screen opening and stop the motion of the slider.

Figure 3 shows single slider rings lower left, slider clusters center top, and rubber balls on the lower right.

Slider clusters work on essentially the same principles as slider rings. The difference is the size is 4 to 8 times larger then a slider ring. Slider clusters are normally used for large diameter machines for easier for maintenance. The impact force is higher due to the larger weight and size, but there are fewer impacts due to the reduced number of clusters.

There are mixed reports on whether individual sliders or larger slider clusters are more effective self cleaning method. The effectiveness is completely governed by the material being screened.

BALL TRAYS

Rubber balls are the second most utilized screen cleaning method, but can only be used for dry screening. The rubber balls are generally 1-3/8” inch diameter and are supported by a second coarser mesh two inches below the classifying screen mesh. Higher vertical separator motion is required to activate the ball cleaning action because the balls must be thrown up against the bottom of the screen.
The larger vertical motion and higher weight balls impart more energy to each impact as compared to sliders or clusters. As a result of the higher impact energy, balls are generally used for coarse meshes which can withstand higher impact energy from the balls. Balls are not recommended for fine screen meshes because mesh damage can occur.

Balls are very good at cleaning near size irregular or jagged shape particles wedged in mesh openings. These same type materials can trap sliders. Balls are also very good for shear sensitive materials where smearing or balling agglomeration can occur. Balls are not recommended to clean fibrous materials because there is no shearing action to dislodge fibers from the mesh.

The disadvantage of ball trays is that the balls spread radially to the periphery of the screen. This generates excellent cleaning action at the screen edge, but leaves the center of the screen un-cleaned.
SANDWICH SCREENS
Sandwich screens are made by bonding a classifying mesh to the top of the screen tension ring and a coarser support screen mesh to the bottom of the ring. This creates a sandwich with screen cleaning devices floating between meshes. This sandwich construction improves cleaning action, decreases maintenance costs, and decreases noise levels.

Cleaning action is improved because sliders are more active bouncing off the bottom mesh as compared to a standard perforated metal plate. The bottom mesh acts more like a trampoline launching cleaners into the mesh more efficiently. The construction also locates the cleaners closer to the classifying mesh allowing a more gentle vibratory motion to provide better cleaning action.

Screen life and motor life are increased because the improved cleaning efficiency of sandwich screens requires less vertical vibration amplitude than standard sliders and balls. Maintenance costs are reduced with increased screen and motor life and screen changes are quicker with the cartridge design of sandwich screens.

Sandwich screens allow the combination of smaller balls inside each slider which can yield better results than sliders or balls individually. The sliders provide complete coverage of the screen surface, and a ball inside each slider holds the balls into position which provides for the ball cleaning action across the entire screen. The smaller balls yield the ideal impact energy and can be used on fine meshes.

Sandwich screens can be used for dry or wet screening and can be fabricated with metal or synthetic meshes. Sandwich screen bottom screen meshes are much better for wet screening because the liquids cannot build up unlike perforated plates.

Finally, sandwich screens are quieter decreasing noise levels over other screen cleaning solutions.

TOP SIDE SCREEN CLEANING METHODS
In addition to the bottom side self cleaning methods, there are top side cleaning devices which reside on top of the classifying screen mesh. These can be divided into three classifications: brushes, wipers and dams.

TOP SIDE ROTARY BRUSHES
The top side rotary brushes are exceptional for clearing fibrous materials which tend to mat on top of the screen and block the mesh openings. The rotary brushes move around the screen diameter propelled by the vibratory motion of the separator, no additional driving motors are required. The brushes ball up the fibrous mat above the screen to expose screen the openings, the fiber balls are then discharged from the top of the screen and out the spout.

The disadvantage to the top side brushes is the bristles which can be lost into the product streams.
TOP SIDE NECKLACE RING DAMS
Top side necklace rings create a radial edge dam to keep materials on the active screen longer. The longer some materials are on the screen, the higher the capacity throughput. This can increase the yield of smaller machines to match the capacity of larger machines.

Figure 5 shows a Top Side Wiper Ring slides around on top of the screen to help clean the screen mesh openings.

TOP SIDE WIPER RING
Top side wiper rings provide the same radial edge dam as a necklace, but also add a wiper which improves capacity with an additional shearing action. This shearing action can wipe fatty materials through the screen mesh, or break up friable clumps to improve capacity or reduce loss. The disadvantage to top side wipers is that they slow or impede material flow through the machine. Materials which tend to ball up should never use a top side wiper.

VIBRO RIM
Vibro rim screens are made by inserting metal ball bearings inside the hollow screen tension ring. The balls create a secondary vibrational energy by impacting the screen tension ring when moved by the vibratory motion of the separator. The ball impact energy is transmitted to the screen mesh through the ring. This excitation helps clean the
radial edge of the screen. This is good for synthetic meshes where unacceptable wear and damage can occur from sliders or balls. The disadvantage is that only the outer two inches of the screen is excited and cleaned.

WATER SPRAYS
Water sprays clear screen mesh openings, help eject solids, and keep slurries from drying out and building up inside separators. Another spray advantage is there is no contamination from slider, ball, or brush materials. The disadvantages of liquid sprays are cost and potential dilution of products.

Stationary spray nozzles are good for cleaning the mesh openings and washing fine particles from over size solids.

Rotary spray nozzles are very good for deblinding and ejecting fibrous or lint types materials.

ULTRASONIC
Ultrasonic screen cleaning uses vibrational energy generated by an ultrasonic frequency transducer attached to the metal screen mesh to generate the screen cleaning action. Ultrasonic assisted screening is good for high accuracy screening where the particle size approaches that of the mesh opening. Ultrasonic energy breaks down electrostatic charges and surface tension which agglomerate particles and prevent efficient screening.

Figure 6A shows the Ultrasonic screen cleaning system installed in a round vibratory separator. The externally mounted electrical control box powers the transducer affixed to the screen tension ring. The screen is bonded to the exciter ring which vibrates the mesh.
The ultrasonic vibrational amplitude is 0.000005 inch occurring at a frequency of 35,000 times per second. The lower amplitude and increased frequency means that the particle lands on the screen openings approximately 1,000 times more often than a standard separator vibration increasing the statistical chances that the particle will go through the mesh opening.

Ultrasonic screen cleaning is the most expensive separation process. Ultrasonic equipment costs are 10 to 20 times the cost of sliders and the consumable screen costs are four times the cost if a tension ring re-screening program is utilized. Therefore it is only used on high value materials and difficult screening operation which cannot be accomplished efficiently by any other method.

ENERGIZER
The energizer is a pneumatic screen vibration generator which operates at frequencies and amplitudes between ultrasonic motion and standard round separator. The pneumatic screen energizer can be used on both synthetic and metal screen meshes.

Figure 8 shows the screen Energizer attached below the screen surface.
The multiple transducers generate a more uniform vibration across the entire screen surface, even on large diameter screens. The pneumatic generators do not use electrical energy and simple mechanical maintenance is required.

The energizer adds the effectiveness of high frequency screen excitation at a lower cost impact. Energizer system cost is 1/3 that of ultrasonic equipment and the disposable screen cost is ¼ that of an Ultrasonic screen.

SUMMARY
1. Sliders and Slider Clusters are the most common screen deblinding method for the majority of wet and dry vibratory separator processes.
2. Ball Trays are used for coarse mesh dry screen cleaning.
3. Sandwich screens generate more efficient screen cleaning action than sliders on perf plates, or ball trays.
4. Screen cleaning devices on the top side of the screen are less common and used for more specialized cleaning applications.
5. Liquid spray cleaning methods are used for unique wet screen blinding issues.
6. Ultrasonic screen cleaning is a high frequency device which is very effective, but limited by the higher process cost.
7. Pneumatic screen energizer systems yield the benefits of high frequency excitation at a lower cost.

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