Clean vibrations: Choosing a screen cleaner for your vibratory separator

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In this article, a dry solids separation expert discusses common screen cleaners for vibratory separators, covering what types of screen cleaners are available, how the cleaners work, and how they're typically applied. This information can help you select a screen cleaner that keeps material flowing smoothly through your vibratory separator.

One of the most common problems with vibratory separators is screen blinding — that is, particles blocking the screen mesh openings. Near-size particles can become trapped in the mesh openings or fines can build up on the wire, as shown in Figure 1, effectively blocking the openings and preventing other material from passing through the screen. Fortunately, you can easily remedy this problem with a screen cleaner, also called an *antiblinding device.*

Screen cleaners are available in many types to handle different materials and operating conditions. Whether you're choosing a screen cleaner for a new vibratory separator or for an existing unit that will handle a new material or process change, you need to work closely with the separator supplier to determine which screen cleaner is best for your application. The supplier will typically recommend a screen cleaner based on the company's experience with materials and operating conditions similar to yours.

The following information describes common screen cleaners and how they're used in vibratory separators. All but the last one, the ultrasonic cleaner, work with both metal and synthetic screens.

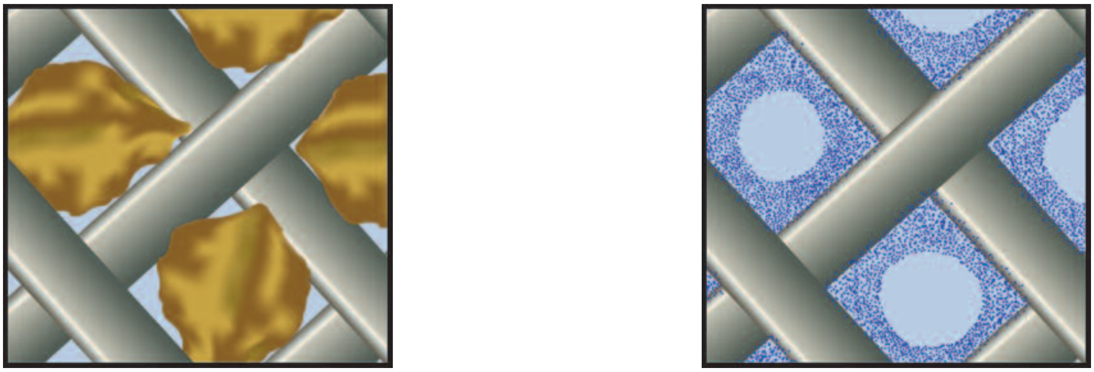
Screen cleaners activated by the separator's vibratory motion, without any other driving force, are considered *self cleaners.* Self cleaners are usually classified by their location in relation to the screen — bottom side or top side — and there are multiple versions of each.

Figure 1

Screen blinding

a. Near-size particles blocking mesh openings

b. Fine particles building up on wires and blocking mesh opening



Bottom-side self cleaners

Self cleaners located below the screen are the most commonly used screen cleaners. Bottom-side self cleaners include sliders, balls, and sandwich screens.

Sliders. The most frequently used screen cleaner is a set of sliders (or *slider rings*), which are individual plastic rings that slide under the screen surface on a slider-support surface (a perforated metal plate), as shown in Figure 2a. The separator's vibratory motion gently bounces the sliders upward against the screen's underside as they travel radially around the screen, cleaning the entire screen.

Depending on your material's properties, the sliders will clean the screen by one of these methods:

- For any material that contains near-sized particles that become lodged in the mesh openings, the separator's vertical motion bounces the slider up onto the screen bottom, dislodging the near-size particles from the openings and freeing the openings for the next particles to be screened.
- With a hard or friable material like granulated sugar, the slider shears (or breaks) particles protruding from the mesh openings into smaller pieces so they can flow through and clear the openings.
- With a soft, pliable material like plastic, the sliders can help the particles through the mesh openings.
- With a fibrous material like rice hulls, the sliders' horizontal wiping motion across the screen bottom will dislodge trapped fibers from the mesh openings.

Sliders are one of the least expensive cleaners and require almost no maintenance; when they're worn, you can simply replace them. They're especially well-suited to use with fine-mesh screens because of their low impact energy and the shearing, wiping action they apply to clean the mesh openings. However, the sliders' impact on the perforated metal plate makes this cleaning method noisy.

Sliders aren't well-suited to materials that tend to ball up or agglomerate inside the sliders, such as toner powder, or materials with extremely hard, irregularly shaped particles, which can partially protrude through the mesh openings and stop the sliders' motion. The small amount of heat the sliders generate can fuse heat-sensitive materials, like paint powders and some plastics.

Slider clusters, shown at the top in Figure 2b, are another version of sliders. They're also inexpensive, require little or no maintenance, and work in essentially the same way as standard sliders in the same applications.

The clusters, which are four to eight times larger than an individual slider, comprise several sliders that are permanently connected to form a round cluster. Their impact force on the screen's bottom surface is higher than for individual sliders because of the clusters' greater weight and size, but they impact the screen less frequently because there are fewer of them. These cleaners are typically used for large-diameter (60-inch or larger) separators because their smaller total number compared with using individual sliders simplifies their removal and replacement for equipment cleaning and maintenance.

Balls. A set of balls made of rubber, polyurethane, silicone, or Viton is the next most frequently used screen cleaner and is also inexpensive. The balls are typically 1⅜ inches in diameter and are supported 2 inches under the separator screen by a second coarser-mesh screen, as shown in Figure 2c. The entire assembly is called a *ball tray.* Because the balls are heavier than sliders or slider clusters, the separator's vibratory action must have a larger vertical motion to throw the balls up against the screen's bottom surface. Along with the ball's greater weight, this larger vertical motion imparts more energy to each ball impact on the screen than sliders or clusters do. As a result, balls are typically used for coarse-mesh screens that can withstand higher impact energy and aren't recommended for fine-mesh screens, which can be damaged by the ball impacts. Like sliders, balls are noisy, but require almost no maintenance and can simply be replaced when worn.

Balls are especially good for dislodging near-size particles with irregular or jagged shapes that become wedged in the mesh openings; these particles can trap sliders, preventing their movement across the screen. Balls are also well-suited to cleaning shear-sensitive materials that tend to smear or agglomerate on the screen. However, balls aren't recommended for cleaning fibrous materials because they don't apply the shearing action required to dislodge fibers from the mesh openings.

The balls' disadvantage is that they spread to the screen's periphery, generating excellent cleaning action at the screen's edge but leaving the center uncleaned.

Sandwich screens. Another common bottom-side self cleaner is a sandwich screen. This cleaner is made by bonding a separator screen to the top of a screen tension ring (which pretensions the screen), bonding another coarser-mesh support screen to the ring's bottom, and placing sliders or balls between the two screens. The sandwich screen can have metal or synthetic screens. The unit's sandwich construction, which forms a *screen cartridge,* provides better cleaning action than using sliders or balls alone. This is because the sliders and balls are more active bouncing off the bottom support screen, which acts like a trampoline, than off a perforated metal plate. The sandwich structure also keeps the cleaners closer to the top screen, allowing a gentler vibratory motion that provides better cleaning action than standard sliders and balls. This unit is quieter than standard sliders and balls because of its gentler vibration and because the cleaners don't impact a perforated metal plate.

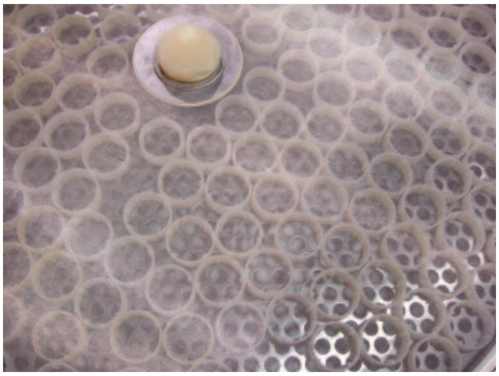
The sandwich screen can also be filled with combination slider-ball cleaners, each consisting of a small ball (a fraction of a standard ball's size) inside a slider, as shown at the right in Figure 2b. They can yield better cleaning results than sliders or balls alone because the sliders provide complete coverage of the screen surface while the balls are moved along with the sliders, providing ball-cleaning action across the entire surface. The small balls provide the ideal impact energy and can be used on fine-mesh screens, unlike standard balls.

The sandwich screen has a moderate cost, depending on the screen size. However, because the sandwich screen requires less vertical vibration amplitude for screen cleaning than standard sliders and balls, it extends the service lives

Figure 2

Bottom-side self cleaners

a. Sliders traveling radially on perforated metal plate



b. Sliders, slider clusters, and slider-ball cleaners

c. Balls bouncing between support screen and separator screen

maintenance costs. The sandwich screen's cartridge design also allows you to change screens faster than with standard sliders or balls.

Top-side self cleaners are typically applied only in specialized cleaning situations where standard sliders or balls won't work.

Top-side self cleaners

Self cleaners placed on the screen's top side are less commonly used than bottom-side cleaners. Top-side self cleaners are typically applied only in specialized cleaning situations where standard sliders or balls won't work; they also aren't generally used with abrasive materials. These cleaners include rotary brushes, necklace ring dams, and wiper rings.

Rotary brushes. A top-side rotary brush is an assembly consisting of four narrow brushes with plastic bristles mounted 90 degrees apart from each other inside a round frame. The assembly rests on the separator screen's surface, and the machine's vibratory motion propels the assembly around the screen, allowing the brushes to clean the screen's entire surface without requiring an additional drive motor. The rotary brush operates very quietly.

The rotary brush is used to clean fibrous materials from the screen. As the assembly moves across the screen, the brushes ball up the mat that the fibrous material forms on the screen surface, exposing the mesh openings. The resulting fiber balls, too large to pass though the screen, are discharged from the separator.

The rotary brush is a relatively expensive cleaner compared with bottom-side cleaners. Other disadvantages are that the brush bristles can fall into the material stream and contaminate it, and you must periodically clean the brushes. However, as with bottom-side cleaners, when the brushes wear out, you can simply replace them.

Necklace ring dam. A top-side necklace ring dam (also called a *wiper wheel*) consists of plastic rings linked together by a polyurethane or stainless steel cord to form one large ring, called a *dam,* that rests on the separator screen's surface at the screen periphery. This relatively inexpensive device quietly moves around the screen with the separator's vibratory motion, keeping materials on the screen longer. This gives larger particles more chances to pass through the screen and improves the separator's throughput capacity. The necklace ring dam can increase a smaller separator's yield to match that of a larger machine.

This cleaner is best suited to friable materials and agglomerates that are easily broken apart, like sugar. The necklace ring dam isn't suited to an application with a large amount of oversize material that can't pass through the screen and has to be discharged from the separator, because the device's tendency to hold this material on the screen longer will slow the process.

The necklace ring dam requires very little maintenance: You can remove it from the separator and clean it by simply spraying it with water or compressed air or soaking it in water.

Wiper ring. A top-side wiper ring consists of the same components as the necklace ring dam but forms a spoke-like wheel shape, as shown in Figure 3, rather than a simple ring. The wiper ring provides an additional shearing action as the separator's vibratory motion moves it across the screen. This shearing action can wipe fatty materials through the mesh openings or break up friable material clumps to improve the separator's throughput capacity or reduce material loss. Like the necklace ring dam, the wiper ring is relatively inexpensive, operates quietly, and requires very little maintenance.

The wiper ring's wiping action makes it unsuitable for any material that tends to ball up. Like the necklace ring dam, this cleaner also keeps the oversize material on the screen longer, making it unsuitable for materials containing a large amount of oversize particles that can't pass through the screen and must be discharged from the separator.

Figure 3

Top-side wiper ring self cleaner

Other screen cleaners

Additional screen cleaners include the vibrating rim, which is another self cleaner, and the ultrasonic cleaner, which is driven by a force other than the separator's vibratory motion.

Vibrating rim. A vibrating rim cleaner is made by inserting metal ball bearings into the hollow screen tension ring holding the separator screen. The machine's vibratory motion causes the ball bearings to bounce and impact the ring's interior surfaces, creating a secondary vibrational energy that's transmitted through the ring to the screen area near it. This excitation helps clean the screen's radial edge. The vibrating rim's secondary vibration helps disperse fine powders, like metal powders, which are its primary application.

The vibrating rim self cleaner has a moderate cost, depending on the screen size, and is good for cleaning synthetic screens that can be damaged by sliders and balls. The device also requires no cleaning, because its ball bearings are enclosed inside the screen tension ring. However, the unit only excites and cleans a 2-inch area around the screen's outer edge, and its operation is noisy.

Ultrasonic. An ultrasonic cleaner, by far the most costly screen cleaner, is used only with metal screens and consists of an ultrasonic-frequency transducer that's attached to the screen tension ring on the separator's screen, as shown in Figure 4a. The transducer generates high-frequency, low-amplitude vibrational energy that transfers from the ring to the screen, as shown in Figure 4b, vibrating the screen 35,000 times per second at a 0.000005-inch amplitude. This ultrasonic energy increases the chances that the particles will pass through the opening by causing the particles to land on the mesh openings about 1,000 times more often than a separator's standard vibration energy can.

The ultrasonic cleaner is well-suited to high-accuracy screening applications in which the particle size approaches the mesh opening size. In this application, the ultrasonic energy breaks down the electrostatic charges and surface tension that build up on the screen so these forces can't agglomerate particles and keep them from efficiently passing through the screen. The cleaner also operates quietly.

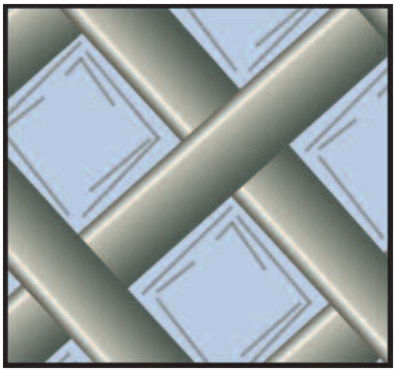
The ultrasonic cleaner's disadvantage is its high cost — from 10 to 20 times more than sliders and balls, for instance. If the screen tension ring will be sent back to the supplier for rescreening when it's worn, the rescreening process will also require removing and replacing the transducer on the tension ring, making screen replacement costly. As a result, using the ultrasonic cleaner is practical only if you have a difficult screening application with a high-value material that can't be efficiently handled by other screen cleaners. **PBE**

Figure 4

Ultrasonic cleaner

a. Separator with ultrasonic cleaner transducer mounted on screen tension ring

b. Ultrasonically vibrating screen mesh



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