

Screener troubleshooting: Diagnosing and solving screen problems

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Whether your screener scalps, removes fines, or grades material, the machine's failure can have costly consequences. A torn or otherwise compromised screen can force you to reprocess material, scrap it, or even recall off-spec product. This article will present some of the common causes of such screen problems and possible solutions.

A screener (also called a *separator* or *sifter*) is a relatively simple piece of equipment that can handle many different types of dry materials. The screener can scalp oversize material, remove fines, and divide material into two or more products with specific particle size distributions.

The screener has one (or more) round or rectangular woven-mesh screen attached to a frame in an assembly called a *screen deck*. A motor drive and motion-inducing equipment (such as a vibrator) provide motion that helps material move through or off the screen (or screens).

A single-deck screener moves material that's too coarse to go through a screen off the screen into a discharge outlet. Material that passes through the screen is discharged separately. A multiple-deck screener removes the coarsest material from the upper deck while finer material passes through to the next screen(s). Each succeeding deck has a finer screen that removes additional size fractions of the material, until only the finest material passes through the lowest screen.

The vast majority of screens are made of woven stainless steel wire (also called *mesh* or *cloth*). The screen is stretched on the frame to provide a specified amount of tension, equalized over the entire screen. Four inter-related parameters, as illustrated in Figure 1, are commonly used to describe the wire screen: wire diameter, opening (the size of the space between a group of woven wires), mesh count (the number of wires per linear inch or the number of openings per linear inch), and open area (the percentage of open space versus wire). The screen can be equipped with several options (discussed in later sections), including backup screen or screen supports; pretensioned screens; sliders, balls, or other antiblinding devices; and others.

When the screener is properly specified, installed, and maintained, it tends to be one of the less troublesome parts of a material processing line. Generally a screener has no high-speed bearings, rotating seals, complex controls, or other failure-prone features. When problems do arise, they can often be traced to improper selection or maintenance of one (or more) screen.¹

Causes of screen problems

Common screen problems that can reduce your screener's effectiveness are listed in Table I, along with their potential causes and solutions. While many screen problems are caused by poor screen selection or maintenance, the specific culprit is often wire failure, screen blinding, or material bypass. Let's explore each of these causes in detail.

Wire failure — a tear or hole in the screen — is the most common form of screen failure. When the screen tears, oversize particles that should be rejected by the screen can pass through it. The consequences can be serious. Not only

does the end product fail to meet specifications, but it can be dangerous: In many applications a screen is used to remove objectionable or even hazardous oversize particles. Once the screen tears, there's no longer any assurance that such particles will be rejected.

Backup screen and screen supports support the fine screen, minimizing the stress caused by the heavy or abrasive material while allowing the fines to pass through.

Wire failure is most commonly caused by *wire fatigue*: During screening, the wire is constantly vibrated. Just as a paper clip eventually breaks when you bend it back and forth several times, the screen wire eventually weakens and breaks from the wire's vibration-induced up-and-down movement. Another common cause of wire fatigue is abrasion, which occurs particularly when you're screening heavy or abrasive materials such as sand and other minerals. The particles' constant movement across the screen abrades the wire, reducing its diameter and making it weaker.

When designing a processing line that includes a screener, you must consider the possibility of wire failure. Your ma-

terial's particle size, weight, and other characteristics, the quantity of material that must be screened over a given time, and other factors all affect how your screens will stand up. You can select a screen (including such factors as its mesh material, wire diameter, opening, mesh count, and open area), mesh tension, and screen attachment method that are suitable for your application.

You can also select options to further ensure your screen's long life. For example, if you're using a very fine screen with heavy or abrasive material, the screen won't last long. But by using *backup screen* (also called *backup mesh*) or *screen supports*, you can extend the screen's life. Backup screen is a coarse screen that's mounted directly under the fine screen on the same screen deck. Screen supports are metal bars, usually configured in an open grid pattern, attached to the screen deck and mounted under the fine screen. Backup screen and screen supports support the fine screen, minimizing the stress caused by the heavy or abrasive material while allowing the fines to pass through. *One caution:* These options can slightly reduce the screener's capacity or make it harder for antibrinding devices to do their job.

Wire fatigue isn't the only cause of screen tears or holes. Foreign or tramp material — such as metal shavings or bolts from upstream equipment — can break right through the screen. Good maintenance practices (discussed in the later section "Screen maintenance") can help prevent this cause of screen failure.

Figure 1

Four inter-related parameters for woven wire screen

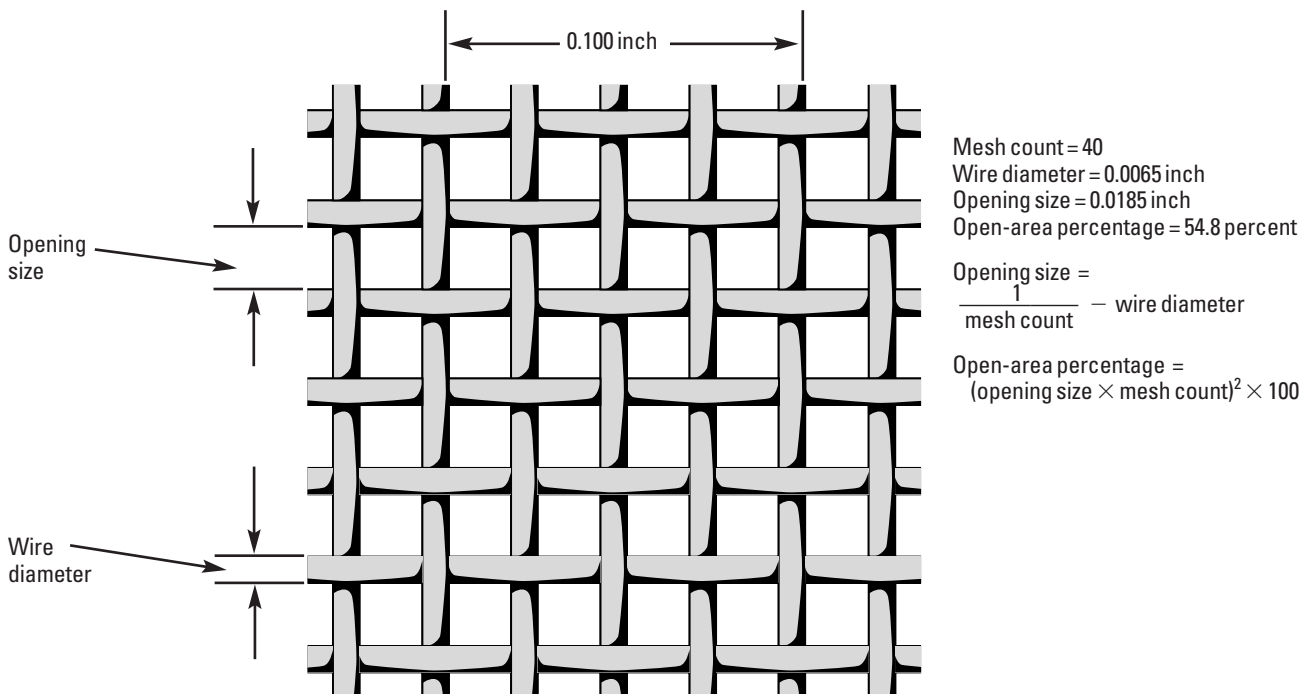


Table I

Troubleshooting screening problems

Problem	Cause	Solution
Off-spec end product: too many oversize particles	Screen opening too large	Select a screen with a smaller opening.
	Hole or tear in screen	Replace screen.
	Material bypass	Check seals and gaskets. Use a pretensioned screen.
Off-spec end product: too many fines	Screen opening too small	Select a screen with a larger opening.
	Severely blinded screen	See "Screen blinding" problem below.
	Screen overloaded	Reduce feedrate.
Low product yield from a multiple-deck screener	Upper screen blinded	See "Screen blinding" problem below.
	Upper screen opening too small	Select an upper screen with a larger opening.
	Lower screen failed	Check lower screen for holes or tears.
	Lower screen opening too large	Select a lower screen with a smaller opening.
Screen blinding	Wire diameter too heavy	Select a screen with a lighter wire diameter.
	Worn sliders or balls	Check antiblinding devices and replace them as needed.
	Screen blocked with material	Clean or replace screen.
	Screen overloaded	Reduce feedrate.
Short screen life	Wire diameter too light	Select a screen with a heavier wire diameter. Use a backup screen. Add screen supports.
	Improper handling	Be careful not to crease or dent screens during handling or installation.
	Screen overloaded	Reduce feedrate.
	Screen corroded	Instead of stainless steel wire mesh, try alternative alloys or use a screen made of a synthetic material.

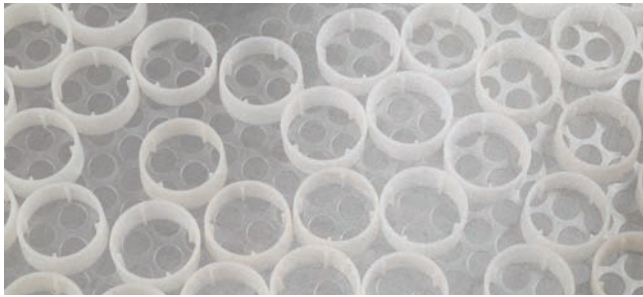
Screen blinding occurs when some or all of the screen's open area is blocked by material. This may be caused by a too-high feedrate that dumps material onto the screen faster than the screen can operate. Or it might be caused by poor screen selection — for example, choosing a screen with too heavy a wire diameter. Or it might be caused by your material's characteristics, such as cohesiveness. Blinding is often behind a gradual degradation in your screener's performance — such as a drop in production quantity or product quality.

Screen blinding causes fines that should pass through the screen to discharge with the oversize particles. As a result, the end product doesn't meet specifications. For example, if blinding occurs in a fines removal application, where the end product is the material that normally passes over the screen while objectionable fines pass through it, product

quality can be compromised. The product's fines content eventually will increase to the point that the particle size distribution falls outside acceptable limits.

If a screen begins to blind and is left untreated, the screen will eventually become totally blinded over. At this point it's no longer a screen; it's simply a conveyor.

Often blinding can be controlled by selecting the right equipment and options such as *antiblinding devices*. Common antiblinding devices are sliders (plastic rings) and balls that are installed on a coarse screen, perforated plate, or other support underneath the screen. The screener's vibration causes the sliders or balls to contact the screen bottom, dislodging any material that might be stuck in the openings.



Antiblinding devices, like the sliders shown here, help prevent particles from sticking in the screen openings.

Over time, many antiblinding devices wear and lose their effectiveness. Proper monitoring and maintenance of the devices will keep your screens clear and free from blinding.

Material bypass is another common cause of screen problems. Material bypass happens when something causes the screen mesh to separate from its frame, allowing material to pass between the mesh and the frame, or — less often — when the gasket or seal between the screen deck and the screener housing fails, allowing material to pass between the screen deck and the housing. The latter problem doesn't occur often; the seal or gasket between the screen deck and screener housing is usually reliable. But certain methods of attaching the mesh to its frame are more likely to allow material bypass.

Commonly, screen mesh is attached to the screen frame by clips or bolts. These are placed at regular intervals around the screen frame, and an operator in your plant or the screen manufacturer's plant manually attaches the mesh to each clip or bolt. In the spaces between the clips or bolts, the mesh isn't attached to the frame, but the screen tension effectively seals the mesh to the frame. If the screen is mishandled, the mesh isn't attached to the frame properly or maintained properly, or a clip or bolt fails, the mesh can come away from the frame, leaving a hole that material can pass through.

If you want to be sure material bypass can't occur, you can purchase *pretensioned screens*. These screens are assembled at the manufacturer's plant and the mesh is epoxied to the screen frame's entire circumference, making it impossible for the mesh to come away from the frame and form a gap.

Screen maintenance

While it's true that practically all screens will fail if left to operate indefinitely, any screen's service life can be maximized through proper selection and maintenance. Proper

screen maintenance starts with regular inspections. Depending on your application, these might be done every hour, every shift, every week, or at another regular interval. Look for tears, signs of blinding, and gaps between the screen mesh and frame.

In addition to finding immediate problems, regular inspections can give you the information you need to take preemptive action to prevent screen failure during processing, which will require you to shut down your process while you change screens. For example, if your inspections show that a screen typically lasts 9 weeks, you can change the screen after 7 or 8 weeks during scheduled downtime and avoid the interruption to your process. Or, if your material has corroded the screen, you can replace it with a screen made of mesh of a different steel alloy or a synthetic material.

After inspecting the screen, clean it off if needed. The cleaning method will depend on your material and process and can range from light brushing of dry, lightweight particles to power-washing of heavy or cohesive particles from the screen.

PBE

Reference

1. For detailed information on how to properly select a screen, see "Choosing a woven wire screen for top separation performance," *Powder and Bulk Engineering*, December 2006, page 17.

For further reading

Find more information on screens and screeners in articles listed under "Screening and classifying" in *Powder and Bulk Engineering's* comprehensive "Article index" at www.powderbulk.com and in this issue.

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