Screening and classifying: A glossary of terms

Having a common vocabulary helps us communicate better when selecting equipment and seeking answers to processing or equipment problems. To encourage clear communication, this glossary defines important screening and classifying terms.

Editor's note: The terms *screening, classifying, sifting, sizing, grading,* and *separating* are often used interchangeably. All refer to separating particles into different size fractions. The following definitions provide more detail about what they and other key terms mean.

Air classifier. Equipment that uses airflow and centrifugal force or gravity (or both) to separate particles into different size fractions.

Amplitude. A particle's vertical, horizontal, or angular motion in relation to the screen of a sifter or screener.

Blinding. Blockage of a screen's holes when they become filled with particles, preventing other particles from passing through.

Centrifugal air classifier. Equipment that uses free- or forced-vortex airflow (or both) to separate material into a coarse and a fine fraction. See *Forced-vortex air classification* and *Free-vortex air classification.*

Centrifugal sifter. Sifter that has a stationary screening chamber, formed by a cylindrical screen. Unit's integral screw feeder meters material into the sifter, and rotating beaters or paddles in the chamber impact the material and accelerate its movement through the screen.

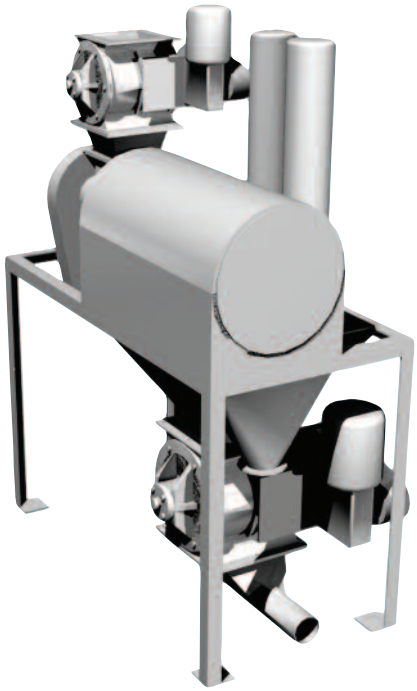
Classifier. Equipment that separates material into two or more size fractions by any of various methods, including gravity, vibration, gyratory motion, and a combination of airflow with centrifugal force or gravity (or both).

Classifying. Separating a material into coarse and fine size fractions.

Cut sharpness. In classification, how much the fractions' particle size distributions overlap.

Cut size. In classification, the particle size that's the "breaking point" between the coarse and fine fractions.

Cyclone separator. Cyclone that's equipped with a vertically mounted classifying wheel and that combines free-



Example centrifugal screener

and forced-vortex airflow. Air and feed enter at the side, while the cyclone (which creates the free vortex) spatially separates the coarse particles flowing near the wall from the fines flowing in the separator's central region (where the classifying wheel creates the forced vortex); the air and fines exit the top, and the coarse particles exit the bottom.

Elutriation. Air classification method in which the particles are air-washed in the gravitational field; the airflow raises the fines against gravity to a fines outlet, while the heavier coarse particles decelerate and fall with gravity against the airflow to a coarse outlet.

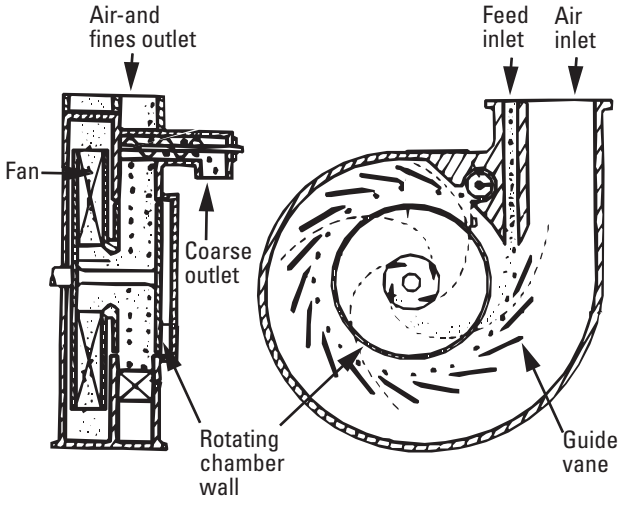
Forced-vortex air classification. Air classification method that draws airflow from the housing's outer edges while a driven vaned rotor (called a *classifying wheel*) forces the airflow with entrained feed particles into a circular motion (a vortex) around the wheel; the resulting centrifugal force throws the coarse particles to the periphery while the fines pass through the wheel's vanes and escape to the outlet with the airflow.

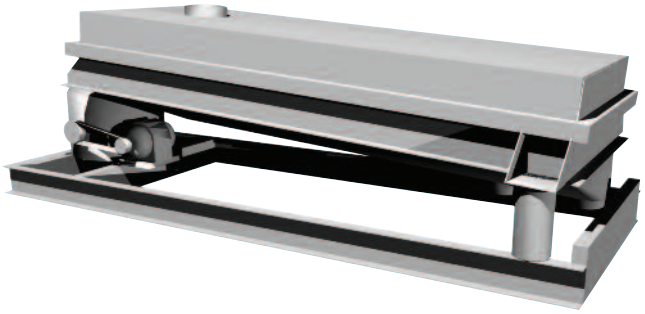
Free-vortex air classification. Air classification method in which an airflow vortex moves in a decaying circular pattern toward an outlet, as in a cyclone; the feed and air enter the housing tangentially, and a set of adjustable guide vanes helps the airflow throw coarse particles to the housing's periphery, where they flow to a coarse outlet, and draws fines inward with the airflow toward an air-and-fines outlet. The spiral separator, shown in Figure 1, is an example.

Grading. Also called *sizing* or *classifying;* using multiple stacked screens to separate material into particle fractions of specific sizes or size ranges.

Figure 1

Example spiral separator





Example gyratory-reciprocal sifter

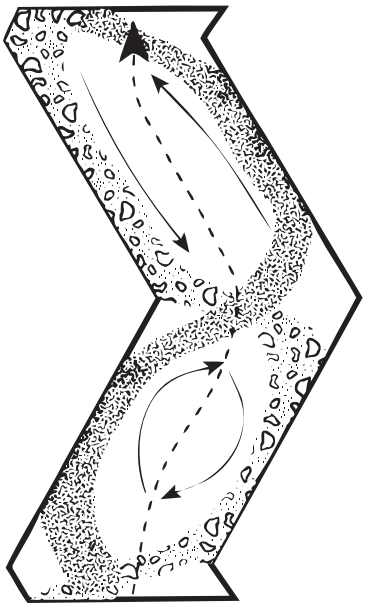
Gravity air classifier. Unit that has a zigzag-shaped classifying channel with a bottom air inlet and side feed inlet; the airflow carries the fines upward against gravity and out the top while the coarse drop by gravity and exit through the bottom, as seen in Figure 2. See *Elutriation.*

Gravity-flow sifter. Sifter in which material flows at atmospheric pressure through the screens by gravity.

Gyratory-reciprocal sifter. Equipment that has a rectangular, relatively steeply inclined screen and a drive mechanism that imparts a gyratory motion at the sifter inlet end and a reciprocating, linear motion at the outlet. Together, these movements provide a gentle elliptical motion that both conveys the material and promotes particle flow through the screen.

Figure 2

Example gravity air classifier



Gyratory sifter or screener. Equipment that has a stack of square, rectangular, or round screen decks, each consisting of a frame and a screen. A drive mechanism imparts a circular motion in a horizontal plane to the screens, producing a gentle sifting motion and maintaining the material's natural stratification — with fine particles adjacent to the screen and coarse particles at the material bed's top. The screens may have the same or different mesh size. (Multiple screens of the same mesh size can increase the screen area to meet application requirements.)

High-energy dispersion classifier. Air classifier that relies almost entirely on forced-vortex airflow and has a high-speed, high-energy classifying wheel. Air enters at the bottom and feed enters at the side, and classification occurs almost entirely inside the wheel, with coarse particles exiting the side and fines and air exiting the wheel's center.

In-line sifter. Sifter that's installed in a pressure or vacuum pneumatic conveying line; material flows through the sifter with the conveying air at the conveying line pressure.

Mesh open area. Percentage of open space between the filaments or wires in a screen. As shown in Figure 3a, several screens can have the same mesh size while having vastly different open areas.

Mesh opening size or aperture. Size of the hole between a screen's woven filaments or wire strands, as shown in Figure 3b. It's worth noting that on an *inclined screen,* the *actual opening size* (the actual measured mesh opening) and the *effective opening size* (the open area particles are exposed to, as shown in Figure 4), can be quite different.

Mesh size. Number of openings in a screen in each direction, from center to center of parallel filaments or wires per linear inch, as shown in Figure 3b.

Example gyratory sifter

Pneumatic blowback. Improperly vented discharge air blowing back through a gravity sifter in a pneumatic conveying system, causing particles to go back up into the sifter instead of into the conveying line.

Scalping. Removing oversize or foreign particles from a material, typically used in quality assurance applications.

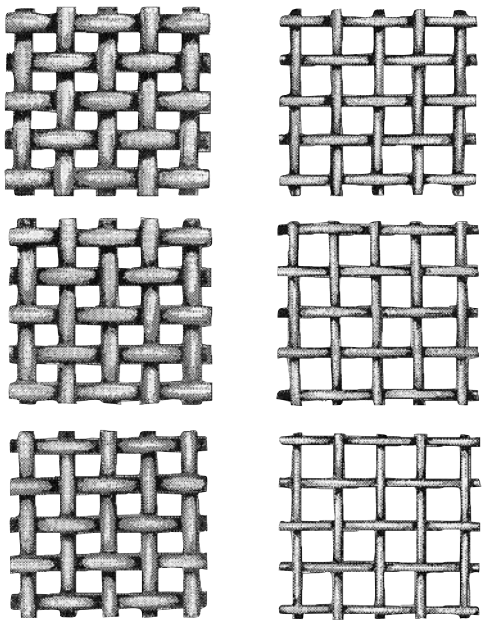
Screen. Also called *mesh;* woven fabric made of either synthetic filament, such as nylon or polyester, or wire, such as stainless steel, magnetic stainless steel, carbon steel, or coated carbon steel.

Screen attachment method. Any of several ways to attach mesh to a screen frame, including mechanical methods (such as using a screen with grommets that attach to hooks on the screen frame, or using a hook strip that attaches to the screen frame with bolts) and pretensioning (in which the mesh is permanently bonded with epoxy to a metal frame that's installed in the screen deck).

Figure 3

Mesh size

a. Open area



b. Mesh size (M) and Mesh opening size (O)

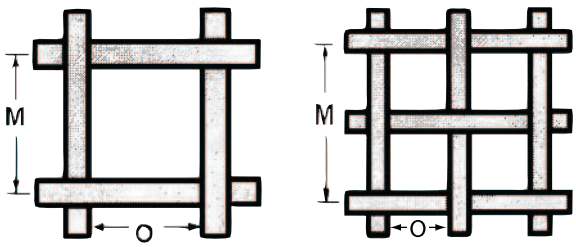
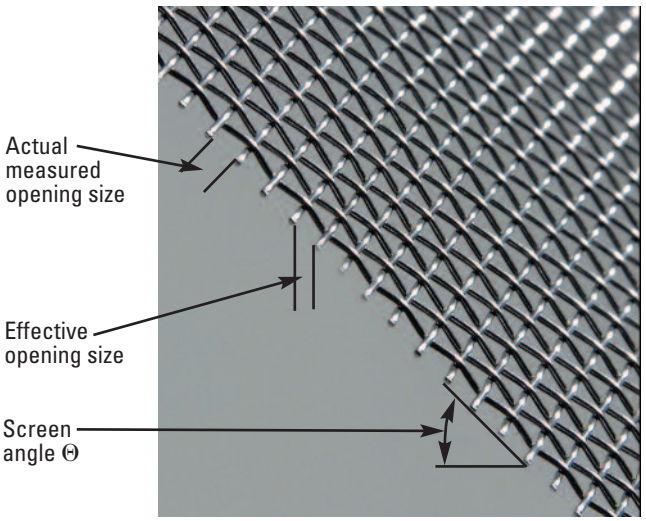


Figure 4

Effective and actual measured opening sizes on an inclined screen



Screen cleaners. Any of various balls, cubes, rings, brushes, or other devices used to prevent screen blinding. Cleaners typically sit on a large-opening wire mesh, called a *backwire,* mounted under the screen in a screen deck; when the screener is operating, the cleaners bounce against the screen bottom, preventing particles from sticking in the screen holes.

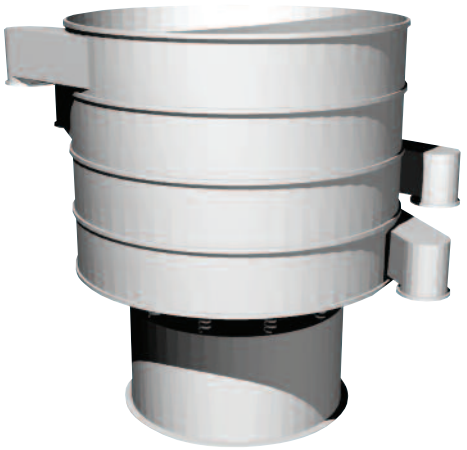
Screen deck. Assembly consisting of a screen attached to a round, square, or rectangular frame. The screen deck is inserted into a screener housing with additional screen decks and other components.

Screener. Also called a *sifter;* equipment that separates a material into two or more size fractions. Used to scalp material, remove fines, or grade material, it consists of one or more horizontal or inclined screen decks, a housing, and often a motor drive system to agitate the material in some way, encouraging it to move through the screens.

Screen tension. Tautness of the mesh (or screen) when stretched and attached to the frame in a screen deck. Maintaining proper tension on the mesh is essential for screening or sifting efficiency because it allows the machine to use less energy and particles to more effectively pass through the mesh.

Sifter. Also called a *screener;* equipment is sometimes defined as separating a material into two size fractions. Consisting of a housing and a wire or synthetic mesh screen, it can be used to scalp material, remove fines, or grade material.

Tailings. Oversize material removed by scalping.



Example vibratory screener

Turbine classifier. Air classifier that has a horizontally mounted classifying wheel and combines elutriation with free- and forced-vortex airflow. Air enters the housing's lower section, and feed enters the upper section. Coarse particles flow downward by gravity, aided by elutriation and the free vortex in the housing below the wheel, and exit the bottom. The vortex flow created inside the wheel entrains the fines, which exit with the air through the classifier's side. A variation is the multiwheel turbine classifier, which has several horizontally mounted classifying wheels around a central air-and-fines outlet.

Ultrasonic deblinding system. System that can be used instead of traditional screen cleaners to prevent material from blinding the screens in vibratory sifters and screeners. The system imparts high-frequency, low-amplitude vibration to a screen, moving the larger particles across and off the mesh surface and the smaller particles through the mesh openings.

Vibratory sifter or screener. Equipment that has one (or more) screen deck, each consisting of a screen in a frame. Material is fed into the unit as a drive mechanism applies both short back-and-forth linear motion and vertical motion to each screen, causing the material's particles to bounce on the screen until they pass through the screen's holes. Typically, each screen deck has a finer screen than the deck above it; material discharges from each screen, separating the material into a different size fraction for each deck. **PBE**

Editor's note

The information in this article has been adapted from past *Powder and Bulk Engineering* articles.

For further reading

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