

A short introduction to long-stroke screeners

Manfred Bruckner J. Engelsmann AG

The long-stroke screener is the gentle giant of bulk material screening. It provides high separation sharpness and throughput without damaging fragile materials. This article explains the basics of how the long-stroke screener works, compares its pros and cons with those of conventional vibratory screeners, and then details how to choose a long-stroke screener.

Screeners used in dry bulk processes must meet three, often competing, requirements: high separation sharpness (or accuracy), high capacity (or throughput), and efficient operation. When handling a fragile material, the screener must also be gentle. For many applications, a long-stroke screener is the best choice to meet all these needs.

Unlike a conventional vibratory screener, which uses high-frequency vertical vibration, the long-stroke screener uses gentle, low-frequency horizontal oscillation to separate particles of different sizes into two or more fractions. Depending on the application, the long-stroke screener oscillates between about 0.5 to 2.5 inches per stroke at about 240 to 440 strokes per minute.

The screener's low-frequency oscillation doesn't reduce its capacity, however. The long-stroke screener has a large screening area, typically between 30 and 130 square feet but exceeding 300 square feet in some applications. The screener handles between 1 and 60 metric tons of material per hour in a typical application but can be configured to handle from 100 pounds to 300 metric tons of material per hour.

The long-stroke screener's high capacity and gentle motion make it well suited for screening many types of materials. The screener's low-frequency oscillation allows it to handle fragile materials without damaging them. Examples include ceramic powders, tea leaves, and chocolate-covered candies. The long-stroke screener is also ideal for screening fertilizers, which are typically free flowing but are also highly abrasive. The low-frequency motion limits wear on screener components even while providing sharp separation and high throughput.

The long-stroke screener's long, horizontal stroke also makes it well suited for handling waxy, fatty, or fibrous materials that often blind the screen openings in a high-frequency vibratory screener. These materials include plastic resins and granules, wax pellets, cellulose fibers, milk powder, nuts, ground coffee, fatty confectionary products, and oat flakes.

How the long-stroke screener works

The long-stroke screener, as shown in Figure 1, consists of a motor and an eccentric (out-of-balance) drive system, a horizontal or slightly inclined rectangular screen trough with one or more screen decks, and, often, a mechanical or ultrasonic automatic screen-cleaning system (discussed

Figure 1

Long-stroke screener

later in this article). The screener's drive system and trough are typically suspended from a metal frame or the building structure using cables or straps. Each screen deck consists of one or more screen inserts (or cartridges), depending on the screener's size. The material and application requirements determine the size of each screen's openings. When more than one screen deck is used, the top screen's openings are largest, with each screen's openings below the top deck decreasing in size. Each screen deck has a discharge, and a bottom pan for collecting the particles that pass through all the decks is typically located below the bottom deck.

In operation, the screener's eccentric drive sets the entire screen trough into horizontal oscillation as material is fed into the screener. The oscillation can be gyratory, reciprocal, or a combination. For a reciprocal screener, the trough moves back and forth in the material flow direction. For a gyratory screener, the trough moves in a circular motion around a central axis. For a gyratory-reciprocal screener, the trough moves in a circular motion at the screener's inlet end and a reciprocal motion at its discharge end.

In each case, the oscillation spreads the material evenly across the screen surface and stratifies the particles, with fine particles sifting down to the screen deck and coarse particles rising to the top. The fine particles pass through the screen, while the coarse particles stay on the deck and flow to its discharge. When multiple decks are used, each screen's decreased opening size separates smaller particles until only the finest particles pass through the bottom deck and flow into the pan.

Screen incline. The screen deck's incline angle is typically adjustable from 0 to about 8 degrees, depending on the application. A more level screen deck can produce higher separation sharpness but will cause the material to spend more time on the screen's surface, reducing capacity.

Screen-cleaning systems. A mechanical screen-cleaning system is typically a perforated deck beneath the screen that holds rubber or plastic balls or discs. As the screener oscillates, the balls or discs bounce against the screen and dislodge near-size particles that get stuck in the screen's openings. An ultrasonic screen-cleaning system uses a transducer with a piezoelectric element to apply ultrasonic vibration to the screen, preventing particles from lodging in its openings. To support the mechanical or ultrasonic cleaning action, the long-stroke screener's horizontal motion sometimes includes a very small (typically 1-millimeter) vertical motion at the end of each stroke.

Wear-protection options. To protect against erosion when handling an abrasive material such as fertilizer, the long-stroke screener's critical wear points can be equipped with wear-protection plates made of special hardened materials, such as ceramic. At the screener's material inlet, for example, a blind plate coated with ceramic can protect the screen mesh and spread the material over a wide area of the screener. Hard protective coatings (or soft coatings, such as plastic or rubber, depending on the application) can also be used to protect points inside the screener where the material flow changes direction, such as walls, corners, and angles. This prevents the screener components from wearing prematurely and increases the screener's service life. Screen inserts and fabrics made of abrasion-resistant, hard-drawn Type 301 stainless steel also significantly increase the screener's service life and reduce downtime.

Pros and cons compared with vibratory screeners

The long-stroke screener is very energy efficient and transfers little or no vibration to its frame or the building. This is because the drive system is precisely balanced to the trough's weight and the entire assembly swings freely during operation. The long-stroke screener's operating noise level is typically only about 75 decibels adjusted (dBa), providing a quiet, safe work environment.

The balanced, low-frequency motion is also gentle on the screener itself, reducing its maintenance requirements and increasing its durability. The long-stroke screener can last 30 to 50 years under normal use and with proper maintenance, which includes having the bearings lubricated and the gaskets, seals, and dampers checked (and replaced if necessary) about every 4 years.

A vibratory screener, on the other hand, is typically not as precisely balanced as a long-stroke screener and tends to be louder, consume more energy, and require more frequent maintenance.

The long-stroke screener typically achieves a separation sharpness between 98 and 99.5 percent and, in some applications, can achieve a sharpness up to 99.8 percent. A vibratory screener, on the other hand, achieves a sharpness between 85 and 92 percent, so many applications would require several vibratory screeners configured in a row to get an accuracey rate similar to that of one long-stroke screener.

For an abrasive fertilizer application with a final particle size range of 2 to 4 millimeters, for example, the long-stroke screener can achieve a separation sharpness of up to 98 percent. This can far exceed the application's required specifications and translate into a higher throughput for the same screen area, providing a significant advantage over a vibratory screener in the same application.

However, the long-stroke screener is typically used for separating particles into just two or three fractions at a high throughput rate. For separating more than three fractions or screening less than 1 metric ton of material per hour, a multideck vibratory screener may be a better choice. Also, a long-stroke screener typically has a larger footprint than a vibratory screener and a higher capital cost.

How to select a long-stroke screener

When choosing a long-stroke screener for your application, expect to work closely with the screener supplier. The supplier can recommend suitable screener models and components based on information you provide about your material characteristics and application requirements. As you consider various screeners, look for features that will maximize screening capacity, simplify required maintenance, and prolong screen life.

To ensure that the screener can provide maximum throughput, choose a model that's designed and configured to retain material for as short a time as possible on each screen deck. This also minimizes material abrasion to the screen fabric and other screener components and increases the screener's reliability while decreasing maintenance costs.

Since the long-stroke screener typically has a large screen area, choose a model that allows quick and easy access for inspecting and changing out screen inserts. For example, the screener can be equipped with a special canvas cover with elastic tension retainers that allow the operator to quickly open and access the entire screening deck without tools. A screener equipped with screen inserts that can be removed using tool-free cam-action locks also reduces downtime.

Consult the supplier to select a screen fabric that can deliver maximum service life in your application. Common screen fabrics include Type 316, 304L, and 304 stainless steels, polyester, and polyamide (such as nylon). These typically last between 2 and 5 years in a nonabrasive application. As previously discussed, to handle an abrasive material, choose abrasion-resistant, hard-drawn Type 301 stainless steel screen fabric, which typically lasts around 6 months. **PBE**

For further reading

Find more information on long-stroke screeners in articles listed under "Screening and classifying" in *Powder and Bulk Engineering*'s article index in the December 2014 issue or the Article Archive on *PBE*'s website, www.powderbulk.com. (All articles listed in the archive are available for free download to registered users.)

Manfred Bruckner *is global sales manager at J. Engelsmann AG (404-490-9416, bruckner@engelsmann.com). He has 29 years of bulk solids handling experience in the chemical, food, plastics, and fertilizer industries.*

J. Engelsmann AG
Ludwigshafen, Germany
+49(0)621-59002-0
www.engelsmann.de