ROTEX® HIGH PERFORMANCE SCREENERS

What is the capacity of my screener?

Utilizing a screener effectively relies on the appropriate settings for the screened material and the desired screening objective. Changing either the feed material or the purpose for using the screener directly impacts its recommended capacity. This is why manufacturers do not assign a specific fixed capacity rating to a machine based solely on the model number.

Each screener is initially customized for the original end user's application. If the machine is repurposed for another application, many of the process variables that drive screener capacity recommendations will also change. That means the same machine originally rated for a certain capacity now needs to operate at a different rate to screen effectively for the new material or objective. Therefore, screener manufacturers need precise details regarding these four key application parameters to determine capacity rate:

- Material Properties
- Particle Size Distribution (PSD)
- Screening Objectives
- Separation Requirements

Material Properties

Bulk Density

First, the material itself requires an assessment, beginning with bulk density. Screening is a volumetric process limited by the screener's set area of wire mesh and the preset diameters for its inlet and outlets. The greater the volume of the material, the deeper the bed depth becomes, reducing the percentage of material that will reach the opening in the screen mesh and separate appropriately. The material bulk density defines the volumetric flow of material within the screener and thus the resulting bed depth.

For example, imagine screening similarly sized fractions of ground barley with a bulk density of 25 lbs/ft3 (400 kg/m3) versus foundry sand with a bulk density of 100 lbs/ft3 (1602 kg/m3). Assuming all other variables are the same, the less-dense barley will run at a volume and bed depth four times greater than the sand. Therefore, the barley requires a lower feed rate than the sand to achieve the same separation performance in the same unit.

Shape

The shape of the particles impacts material flow through the screener, which impacts the screening capacity. Most materials come in jagged, granular or round shapes; typically the separation occurs on a square wire mesh. The more irregular or jagged the shape of the particles, the slower the material flow. The more uniform the shape, as with granular and crystalline particles, the easier the separation, resulting in faster material flow. As the material flow rate increases through the screener, the bed depth decreases, resulting in a higher screening capacity.

For example, if two plastic products are screened on the same machine, but one has a uniform shape as seen in the first image and the other has an irregular shape as seen in the second image, the capacity rate for the uniform material will likely be higher due to the increased material flow and shallower bed depth.

Round plastic pellets

Moisture

Moisture within a product, whether from water, oil or fat, hinders separation and slows capacity. More specifically, the type of moisture and how densely it packs the material together makes a difference in that outcome. For instance, some agricultural products have an inherent 5% to 10% moisture in their composition that has less impact on capacity rate than the 0.2% or 0.3% moisture found in industrial or frac sand.

A moist material that sticks to itself requires processing through a dryer prior to screening, because the self-adherence makes efficient separation highly unlikely. In the field, conducting a quick "snowball" test of squeezing a handful of the material together can determine if the material is too moist for an efficient separation. If the squeezed material clumps together, it needs to be dried first.

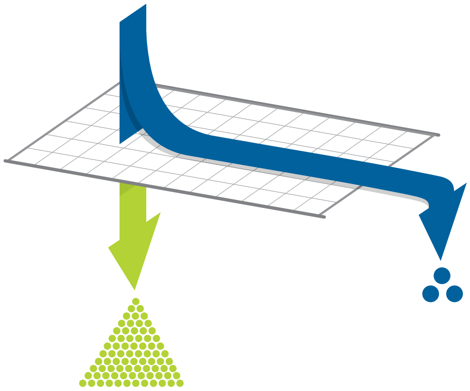
Jagged and irregular recycled plastic

Particle Size Distribution (PSD)

Ascertaining the particle size distribution is achieved by running the material through a stack of increasingly finer sieves (typically a Ro-Tap® machine). The amount of product retained on each sieve profiles the feed by determining the concentration of particles at each separation point. Understanding this distribution greatly influences the overall capacity of the machine in relation to the screening objective.

Screening Objectives

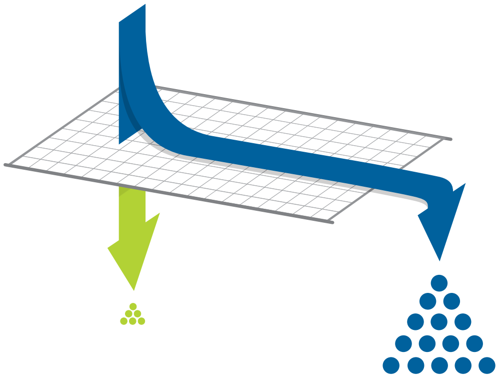
The screening objective defines the core purpose of what the equipment is trying to achieve through separation. The complexity or simplicity of that goal drives the recommended capacity for that machine. The objective can be as simple as removing dust or large clumps from the product, or as complex as separating the material into five different fractions, each with quality specifications. Following are the three most common screening objectives.



Overs Removal
The small percentage of unwanted larger particles pass over the screen to a separate outlet, leaving the desired smaller particles to drop through the mesh.

1 Overs Removal

"Overs" refers to any particle larger than the desired size of the final product, such as separating clumps of flour from the fine particles to generate the desired final product. Generally, this screening application removes less than 5% of the total feed. Because there is only a small percent of overs and a large size disparity between the overs and product fraction, the process lends itself to the highest capacity rate.

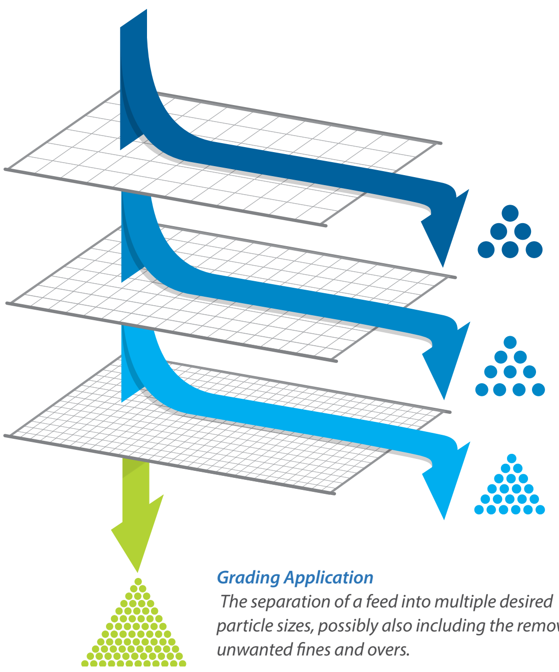


Fines Removal
The desired larger particles pass over the screen to a separate outlet, leaving the small percentage of unwanted smaller particles to drop through the mesh.

2 Fines Removal

Fines removal separates the finer particles from a product, usually totaling less than 10% of the feed.

In cereal, for example, the fines often range in size from broken bits to fine dust, all much smaller than the desired product size. With fines removal, most of the feed material moves over the screen with very little needing to pass through the mesh. This increases the bed depth, which requires a lower capacity to achieve optimal efficiency when compared to overs removal.



Grading Application
The separation of a feed into multiple desired particle sizes, possibly also including the removal of unwanted fines and overs.

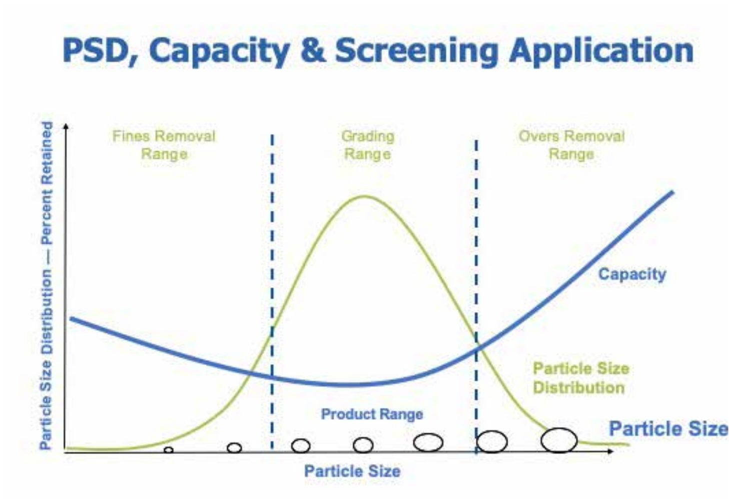
3 Grading

The most difficult screening application, grading removes both fines and overs from the feed material. At its most complex, grading might separate the product into several different size fractions within a single screening machine.

For example, in salt applications, the user may want to create two or three final products from the same material. The coarsest particles might become salt for de-icing roads, the middle fraction may end up as an ingredient for animal feed, and the finer particles serve as granular table salt.

This grading would need four separation points. The top screen would remove the largest particles considered unacceptable in the de-icing product, while the bottom (smallest) screen would remove the dust from the granular table salt. The two middle decks would separate out the animal ingredient salt and the table salt.

Accuracy and efficiency are critical components for optimal return on investment in grading. Depending on the amount of concentrated particles near the separation points, it usually requires the lowest capacity among screening objectives.



Separation objective and its impact on screening capacity

Separation Requirements

Product Quality

The quality requirements for the final product can add intricacies to the screening process that directly impact the capacity of the screener. Quality assessment can range from visual inspection to full-scale particle size distribution analysis of the final product.

For instance, in agriculture, some end users simply look at the soybeans and corn to assess the quality of separation from unwanted organic pieces, like pods and sticks. In other cases, the user needs more measurable and quantifiable quality assurance and often within very specific parameters. The sieve analysis used for particle size distribution may set the maximum allowable limit of oversize and/or undersize particles in their final product.

For example, in producing granular table salt, quality requirements may only allow a maximum of 5% fines and a maximum of 10% overs in the product fraction. When a product is screened using quality specifications, the capacity becomes critical to the accuracy of the process, making this form of screening the lowest capacity of any application.

Conclusion

Investing in a screener and not setting the correct capacity rate can eat away at profits, impact product quality and potentially damage the equipment. But because all screeners are customized somewhat to their initial purpose, only an accurate understanding of the material properties, screening objectives and separation requirements can establish the machine's capacity.

The best course of action, therefore, is to talk to an industrial screening expert, like Rotex Global, LLC. Rotex has been around for over 175 years, innovating and leading the bulk material separation industry. Our experts can walk users through the numerous criteria that impact screening and performance. The user can then feel confident in exactly what capacity the used, repurposed or new machine can achieve for optimal effectiveness.