Ultrasonic Sieving in the Powder Coating Industry

With increasing focus on profitability of powder coating production and the need to maintain product quality, the demands made on vibratory sieving equipment has grown dramatically

The Powder Coating Industry

Over the past few decades, the powder coating industry has seen double-digit growth in the US and Europe. Many new markets have emerged to take advantage of this high performance film coating, from automotive components like wheels and suspension systems, to oil and gas piping through to domestic appliances like washing machines and microwave ovens. With its superior toughness and chip resistance and its simple method for overspray recovery, powder coating has proven to provide exceptional coating properties over conventional liquid paint systems. However, over the past few years, with a slowing market and rising raw material costs, manufacturers are being forced to look even more closely at all aspects of their business to maintain growth and healthy profitability.

The Process

The powder coating process (see Figure 1) involves a number of steps taking the raw materials through various stages to form a 'plastic' mix. This is then cooled and broken down into plastic chips before being micronized and passed through a cyclone classifier to separate the large and fine particles.

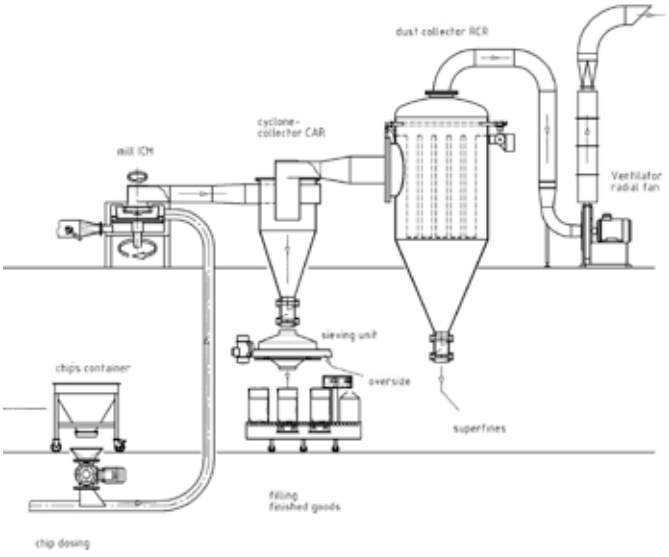

Figure 1: A typical Powder Coatings Manufacturing Process. (Source: courtesy of Neuman and Esser).

Finally, the fine powder is screened to remove extraneous contaminants and oversize caused by material that has polymerized during up stream processes. Screening the powders at this stage ensures only powder of the correct particles size is passed through to the filling line (See Figure 2).

Figure 2: Typical installation supplied by Neuman and Esser with the screening operation commonly positioned under the cyclone prior to the filling lines.

This is critical because this will have a direct impact on the quality and film thickness that can be obtained during the coating process. Too thin will result in an inadequate coating, too thick will waste money.

Traditional Methods of Sieving – Problems Faced

Since the powder in coating processes are designed to hold a static charge, this has traditionally caused problems during screening due to blinding and blocking of the mesh apertures, compromising both product quality and sieving capacity. To overcome this, some manufacturers have experimented with 'off-line' screening but this has led to quality

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control problems. Others have adopted rotary sieves taking advantage of the centrifugal action caused by the impeller forcing the powder through the mesh. However, this can also compromise product quality since very little oversize is collected during the screening process.

Another possibly more concerning drawback to using rotary sieves is that most are fitted with nylon mesh that is prone to breakage. Gravity fed circular vibratory sieves are the preferred method since they ensure only particles below the aperture size of the mesh pass through to the filling lines. Historically, spring mounted sieves have been used, however, these are very difficult to dismantle resulting in extremely long and laborious cleandown times. With the recent changes in the market, batch sizes are reducing creating a need for more frequent product changeovers. This has resulted in a dramatic increase in production downtime and costs due to the amount of time taken to cleandown equipment. This therefore has caused manufacturers to become more aware of this process inefficiency and to look at alternative solutions.

The Solution – Compact and Easy-Clean Screening

Recently celebrating their 75th anniversary, Russell Finex have been supplying separation solutions to the coatings industry for many years and have therefore obtained a great deal of experience in order to understand the challenges faced and how to overcome them. With investment into developing new products and the advancement in technology, Russell Finex have developed the ultimate screening solution for this application. By combining the Russell Compact Sieve® and Vibrasonic® Deblinding System, the most efficient screening system can be obtained.

The Russell Compact Sieve® as its name suggests has a low profile, 'straight through', in-line design enabling much higher production rates when compared to other vibratory sieves. These smaller sized sieves are now one of the most widely used screening solutions across numerous industries. Companies appreciate having units with a small footprint as space requirements are often limited, but capacity levels must remain high to ensure there are not bottlenecks in the process which would compromise profitability. Having the motor mounted on the side also means the unit can be installed mid-platform or on a mobile stand allowing filling lines to be installed directly underneath the product outlet saving space (see Figure 3).

Another fundamental feature of this sieve is its easy-clean design. When changing colors it is essential that the process lines are cleaned extremely well to prevent cross contamination of batches. Unlike conventional spring mounted or rotary sieves that are notoriously difficult to dismantle and clean, the Russell Compact Sieve® has a hand-operated clamping system, which enables the unit to be dismantled in seconds without the need for tools. In addition, having a crevice free design with very few product contact parts makes cleaning this sieve effortless.

Figure 3: The Russell Compact Sieve® installed before the filling lines at Jotun UAE.

Idar Larsen, project manager at Jotun A/S states, "Any risk of product contamination has been eliminated completely with the Russell compact screeners. Compared to the rotary units we replaced, they are very simple to dismantle and clean. In addition, we no longer have pieces of nylon mesh finding their way into the product which was a frequent problem we experienced with the rotary screening machines."

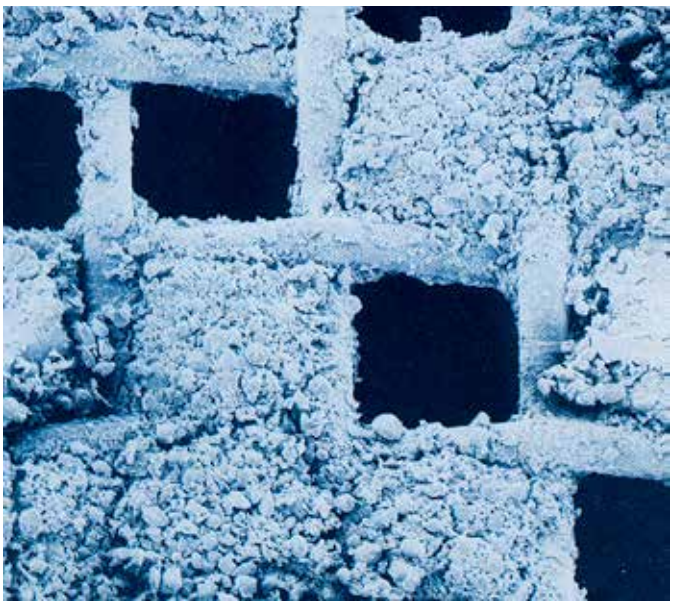

Figure 4: In a typical sieving operation, particles often combine to blind the stainless steel wire mesh. Ultrasonic deblinding systems can eliminate this problem. (Source: courtesy of G. Bopp & Co. Ltd).

Due to the characteristic of powder coatings a static charge can often build-up on the sieve mesh, resulting in mesh blinding and blockage. This reduces the useful screening area and the screen's overall capacity, slowing down production rates (see Figure 4).

Many companies try to clean their screens manually, but this can often cause damage either through incorrect handling or cleaning methods resulting in premature mesh failure. Other companies use screening systems that incorporate mechanical devices such as discs or balls that bounce up and down, hitting the screen and shaking free any blockages. Unfortunately, the action of these discs can also damage and reduce the life of the mesh. Even more seriously, as these devices wear down, pieces of their rubber or plastic construction can fall off and contaminate the powder being sieved.

Inventors of the first ultrasonic system over 25 years ago, the Russell Vibrasonic® Deblinding System applies an ultrasonic frequency to vibrate the sieve mesh (see Figure 5). This breaks down the surface tension, effectively making the stainless steel wires friction-free. The system has no mechanical or wearing parts, so there is no risk of mesh damage or product contamination. Because it prevents the mesh from being blocked or blinded, it ensures the screening capacity and throughput remains constant throughout the production process. Downtime for cleaning is also dramatically reduced while increasing mesh life due to the reduction in manual handling. This also means that less good powder is wasted.

Figure 5: The ATEX approved Vibrasonic® probe is certified for use in Zones 20, 21, 22, 0, 1 and 2 and can be fitted to all Russell Sieves.

Both the Compact Sieve and Vibrasonic® system are ATEX approved to operate within all Zones including 0 and 20. They can also be specified to match existing milling systems to ensure production rates are upheld; these can be seen in the table in Figure 6.

Sieve Model	Mill Size	Mesh aperture size (μm)	Capacity (T/hr)
Compact 1200	ACM 50 - 60 ICM 48 - 96	125	1.5
		150	2
Compact 900	ACM 10 - 30 ICM 24 - 38	125	0.5
		150	0.8
Compact 600	'Off-line' recovery	125	0.25
		150	0.4

Figure 6: The table shows how the Compact Sieve Range can be matched to a range of mills (Neuman and Esser and Hosokawa models shown)

"With the introduction of the Russell compact screeners we have seen a dramatic increase in our screening efficiency, providing us with significant advantages." He continues, "this means that only oversize particles are ending up in the oversize fraction. With the traditional rotary screening machines we were using, a lot of good product ended up in the oversize fraction." Larsen concludes, "We feel we have found the best technology available in the market."

In order for powder coatings producers to survive in this ever-increasing competitive industry, embracing new technologies to improve the efficiency of manufacturing processes is essential to ensure that product quality is upheld while ensuring profitability is maximized.

For over 75 years Russell Finex has manufactured and supplied filters, screeners, and separators to improve product quality, enhance productivity, safeguard worker health, and ensure powders and liquids are contamination free. Throughout the world, Russell Finex serves a variety of industries with applications including coatings, food, pharmaceuticals, chemicals, adhesives, plastisols, paint, metal powders and ceramics.

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