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ALMO Process introduces a new screening technology for high-pressure screening applications. The new Vibrall D 800 HP can screen products under pressure within a pneumatic conveying line. Applications for this technology include flour, starch, and plastic granules. Measuring slightly more than a cubic meter, the Vibrall D 800 HP keeps a low profile in the process flow, while still performing necessary screening duties. It can withstand maximum overpressure up to 2.5 Bar. Design capacity is 25 to 30 metric tons per hour (depending on air flow). The drive motors provide double amplitude oscillation up to 5 mm with acceleration of up to 6 g. The screener is available in stainless steel 304 and FDA conformance.

ALMO Process, Cincinnati, OH 513-453-6990
www.allgaierscreener.com

High-Capacity Color Sorter

The REZS4000 is a new high-capacity, cost-effective, full-color precision optical sorter for bulk agricultural products such as seed, wheat, and other small grains. It can consistently sort applicable product up to 10 tn/hr. The machine comes standard with 6 x 224 mm flat chutes. Multiple configurations are available for secondary and tertiary resort options. The REZS4000 is powered by patent-pending Satake software, ensuring quick set-up and hassle-free operation. A simple user interface, similar to a smart phone or tablet with touch and flick operation, offers the operator quick adjustments to a number of settings and sensitivities.

Satake USA, Houston, TX 281-276-3600
www.satake-usa.com/rezs

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Salt Screening System Boosts Efficiency, Capacity

Compass Minerals is a leading producer of essential minerals, operating 13 production and packaging facilities throughout North America and the UK. The company's focus on sustainable growth and disciplined capital allocation is evident throughout its operations, including the world's largest rock salt mine, located in Goderich, Ontario; the largest rock salt mine in the UK; and a solar evaporation facility in Ogden, UT, which is both the largest producer of SOP and solar salt production site in North America. Its packaging facility serves key markets in deicing, animal nutrition, water conditioning, and industrial applications through further processing from both the Goderich, Ontario and Cote Blanche, LA rock salt mines. The Chicago plant has been in operation since 1982 and had used the original screening process until the salt screening improvement project in August 2014.

Challenges

Plant design and layout - The Chicago facility's screening system is located throughout the top four floors of the process tower above bulk material storage silos. Below is a description of the existing design layout:

- (top level, 6th floor) screw conveyors and feed chutes supplied bulk material to the screener for processing.
- (5th floor) two "primary" double-deck high-incline vibratory screeners generated a coarse size fraction and removed fines from the material stream.
- (4th floor) two additional "secondary re-screening" single-deck high-incline vibratory screeners were used for re-processing the intermediate size fraction from the primary screeners. This level also included two screw conveyors and multiple chutes for transferring material from the primary screeners.
- (bin top level, 3rd floor) material handling equipment distributed salt from the system to various storage silos through numerous chutes, valves and 10 additional screw conveyors.

Compass Minerals identified the potential value of improved material flow, including reduced utility costs and less product damage.

Plant capacity – The design wasn't the only concern surrounding the screening system. Compass Minerals faced many challenges associated with screening performance of the high-incline vibratory screeners. Most concerning was the effect that slight moisture fluctuations had on the overall processing rates. Variations in salt shipments and material segregation in storage contributed to different moisture

Figure 1: Original installation of high incline vibratory screeners and chute work

levels, which could drop production rates from 60 to 40 tn/hr. The primary factor was poor blinding control on the high-incline screeners. Blinding occurs when the salt builds up on the screen surface, or when irregular granules become lodged in the screen. The result is loss of open area and capacity. According to Terry Spencer, Chicago plant manager, "The only way to keep the screens from blinding was to dedicate an employee to stand and brush off the screens manually as they began to blind. In a normal distribution of feed, the operator would be dedicated to do this for 10-15 minutes every hour. If we saw a shift in our material that resulted in more fines or greater moisture, this would increase to 25-30 minutes every hour."

Blinding created several issues including more staffing with around-the-clock monitoring, maintenance associated with premature screen failures, quality concerns with wire bristle contamination, and worker safety.

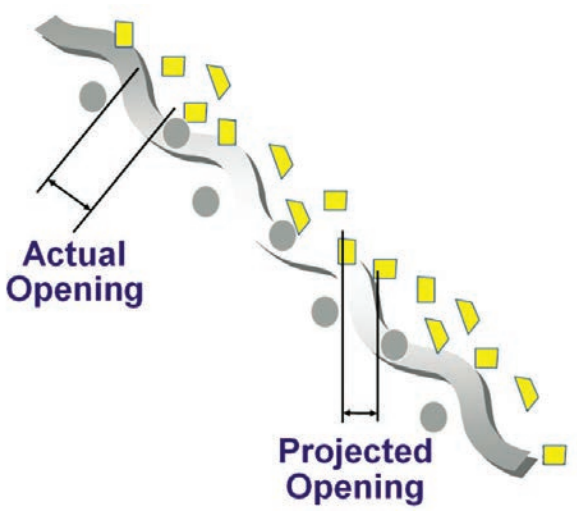

Figure 2: Inclined Screen Clothing Actual Opening vs. Projected Opening

Product Quality - Along with capacity concerns, the original screening equipment struggled to provide accurate separations as well.

Blinding created several issues including more staffing with around-the-clock monitoring, maintenance associated with premature screen failures, quality concerns, and worker safety.

High-incline vibratory screeners have a steep slope, typically 30 degrees or more, and a high-frequency short stroke vibratory motion. Both contribute to decreased screening efficiency. The high-frequency vibratory motion bounces the salt, meaning the particles are airborne instead of in contact with the screen. The steep slope accelerates the conveying rate of the material through the screener. Combined, these designs reduce retention time on the screen. Decreased retention time effectively reduces the opportunities for particles to pass through the screen opening before the end of the deck. Material that would pass through standard test sieves ended up tailing over into the coarser oversize fraction.

The second factor contributing to decreased screening efficiency is caused solely by the slope of the machine and resulting effect from the geometry of the opening and screener slope. As the slope of the screen cloth increases, the actual opening dimension is effectively reduced to the projected opening size (See Figure 2) and closes off the screens openings. If you have quality specifications for the top or bottom of your material sizing, as Compass Minerals did, you must deviate from target separation size by determining the actual opening that corresponds to the necessary projected opening required to meet your product specification. This leads to inconsistently sized material with overlapping materials in the two separate size fractions. If the actual opening is not sufficiently increased, it can cause the tail over effect. If the projected opening is too small, it will allow the on-size product to flow over the screen without falling through or increase the screen mesh opening and permit oversized material to pass into smaller sized material fractions.

In order to maintain required efficiency and reduce the amount of undersized material in their screened salt, while continuing to meet customer supply demands, Compass Minerals used slotted openings instead of square openings. The slotted openings control excessive material from tailing over despite the amplified separation inaccuracy of the system. This particular screening cloth determined the difference between their lowest and highest value materials. While this solution met market demands and the goal of delivering where and when it matters, Compass was doing so at a cost and saw a significant portion of its high demand, high value product passing its screens and into lower value/limited demand streams.

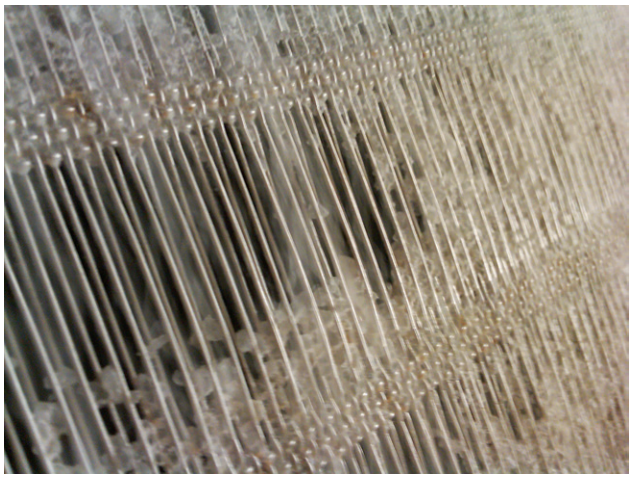

Figure 3: Slotted wire blinding on the high inclined vibratory screeners

Maintenance - Finally, the last challenge of the original screening system was the maintenance associated with screen replacement. With the high-incline vibratory screeners you first had to remove the top cover to access the screen decks. Since the units installed were double-deck screeners the top deck also had to be removed to access the second deck where the finer screen cloth is installed. Since the second deck has the finer screen and is most prone to damage, it needs to be changed most often. Therefore, nearly all screen cloth replacements required complete disassembly of the top cover and both screen decks. This was no easy process as it would consume an entire eight-hour shift, requiring five maintenance people for four screeners. The implications of these maintenance activities on meeting their operational objectives were equally as significant, since screen damage was not predictable and typically increased

during periods of highest demand where additional operating hours were not available to offset downtime.

Solution

Jason Vogt, senior mechanical engineer for Compass Minerals, was assigned to address the processing challenges and would be responsible for the implementation of the facility's salt screening system improvement project.

Review of the existing challenges indicated that the current high-inclined vibratory technology wasn't right for the particular application and there was a change needed in the screening technology. Vogt was familiar with a variety of screening technologies and vendors, including Rotex, whose screening equipment Compass Minerals used at other production and processing facilities throughout North America. After a thorough review of best technology for the application, the team determined that the long-established gyratory-reciprocating motion would be right for the job.

Starting with a blank slate, Compass Minerals took advantage of the Rotex testing facility in Cincinnati. According to Vogt, "We utilized the resources in the Rotex testing department to look at all options available. We weren't just asking ourselves how can we improve the current setup and process but what if we redefined the process completely."

With this in mind, they ran a gamut of tests in the first quarter of 2014 until the final solution was developed. "The technical experience that Rotex provided really helped us narrow down all the conceptual ideas that were thrown into the mix initially to define our final solution. The expectations and statistical results developed during our lab testing scaled up perfectly to match our full scale installation," Vogt said.

Ultimately, Compass Minerals was able to replace all four high-incline vibratory screeners with one MM3090-3 Rotex Minerals Separator.

Ultimately, Compass Minerals was able to replace all four high-incline vibratory screeners with one MM3090-3 Rotex Minerals Separator. The single unit is capable of processing at a higher peak capacity and is less affected by moisture fluctuations, while producing higher quality products than the previous system. The Minerals Separator has a higher throughput with greater screening efficiency and accuracy for these reasons:

Figure 4: Rotex Minerals Separator Installation

- The first is the screening motion: The Rotex motion combines a gyratory motion at the feed end with a reciprocating motion toward the discharge end of the machine. Because it is entirely horizontal, the salt remains in contact with the screen, providing a longer retention time for the product and eliminating product tail over.
- The gyratory-reciprocating screening motion provides positive ball mesh cleaning to eliminate the manual de-blinding techniques used on high incline vibratory units. Because the screens remain clean, the screening rate is consistent and accommodates moisture variations in the salt.

Results

Plant design and layout - With the replacement of four screeners with a single Rotex Minerals Separator, the process layout became much simpler. The Minerals Separator required only a single supply from Compass Minerals' existing elevator, allowing its placement on the top level of the process tower in the same space. The two levels with the high-incline screeners were no longer needed, as the necessary screening equipment was consolidated into the single Minerals Separator on the 6th floor. A further benefit was the additional head room created by eliminating the screening units on the two levels below the new machine. This allowed Compass Minerals to work with its existing material handling equipment vendor, Ranco Fertiservice, to design a new handling system with the use of simple diverters and chute arrangement. With the help of gravity, the system could more reliably feed the various storage silos and eliminated the need to retain the existing 13 screw conveyors.

This new design and layout was extremely valuable to Compass Minerals as Vogt explains, "The additional space created in the processing tower gives us the opportunity to utilize additional processing equipment for other

applications and also promotes future growth opportunities at the plant."

Figure 5: Rendering of new plant layout with Rotex Minerals Separator

Plant capacity - Since the completion of the salt screening system improvement project in August of 2014, the plant has increased its screening capacity by almost 50%. The Rotex screening system has allowed the plant to consistently exceed historical screening records and from September through December 2014, the company to exceed its previous record by more than 30%.

Product Quality - With the benefits of the alternate screening technology highlighted in the "Solutions" section, Compass Minerals is capable of accurately separating material to increase the yield on high-margin material, along with an increased efficiency in removing undersized material. Improvements in screening rates further support the ability to service customers with decreased lead times. With the performance of the ball mesh cleaning system utilized by the Minerals Separator, the manual wire brush cleaning is no longer necessary, eliminating the risk of product contamination from wire bristles.

Maintenance – As can be expected, the maintenance involved with the Rotex Minerals Separator is minimal compared to the high-incline vibratory units. Screen replacements were reduced from a five-man team working an eight hour shift for all four units, to a four-man team working two hours to change all screens. In addition to shorter replacement time, the Minerals Separator has doubled the average screen life of the prior system. Terry Spencer says the frequency during even the heaviest production periods was reduced by more than 40 days. "The old units would require change out every 10-20 days, while the new Rotex units can go 60 plus days before a change is needed," said Spencer.

The project has been a success since going live in mid-August of 2014. It was so successful that post-completion review of the project deliverables indicated the capital rate of return was satisfied before year-end. That is a four-and-a-half month payback period, or 266% ROI annually. According to industry averages, the annual ROI for heavy manufacturing is 29% annually, making it a three-and-a-half year payback period. The accelerated return is due to the reduced cost of maintaining the unit, screening efficiency, and sales volume due to the increased capacity. The installation of the new Rotex screening system has provided the ability to generate additional sales volume and increased revenue on high-demand products with improved margins. This project has strategically benefitted the Chicago packaging facility and supports Compass Minerals' goal to be the best essential minerals company by delivering where and when it matters.

Rotex develops screening equipment for dry separation, including size analysis, feeders, and conveying machinery. For more information, visit www.rotex.com