OPTIMISING HIGH FREQUENCY SCREENING EFFICIENCIES

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outline the benefits of utilising an automated electronic wire mesh cleaning system to improve efficiencies and product yield.

High frequency screening machines are inclined static body machines which incorporate an isolated high-speed drive directly connected to the screen media. This type of screening system produces accelerated, low amplitude vibrations to the wire mesh, providing effective and efficient product separation.

Given the inclined arrangement, gravitational flow benefits, and the fact that vibrations are segregated from the screen media, there are minimal power requirements and consumption. There are also negligible load transmissions to the supports and auxiliary equipment, benefitting civil and structural conditions. Inclined high frequency screening machines are ideal for scalping, oversize, product, and fines separation, and are widely used throughout the phosphate processing industry.

Process screening and throughput

Low amplitude, high frequency vibration is transmitted to the wire mesh to increase fluidity of granules on the screen media. This has

three important effects on the material: firstly, the movement reduces friction between the granules, improving flow characteristics for maximised sieving. Secondly, this vibration pattern reduces friction between the material and the wire mesh, which reduces blinding. Lastly, high frequency, low amplitude vibration results in stratification of particles. Smaller particles descend towards the wire mesh surface while larger particles ascend. This action forces near-size particles to maintain contact with wire mesh and screen efficiently (Figure 1).

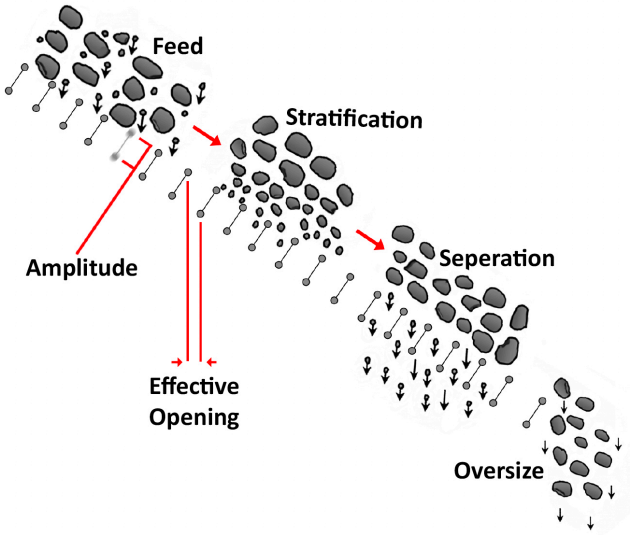

Figure 1. High frequency screening through material stratification.

Figure 2. Blinded screen wire mesh.

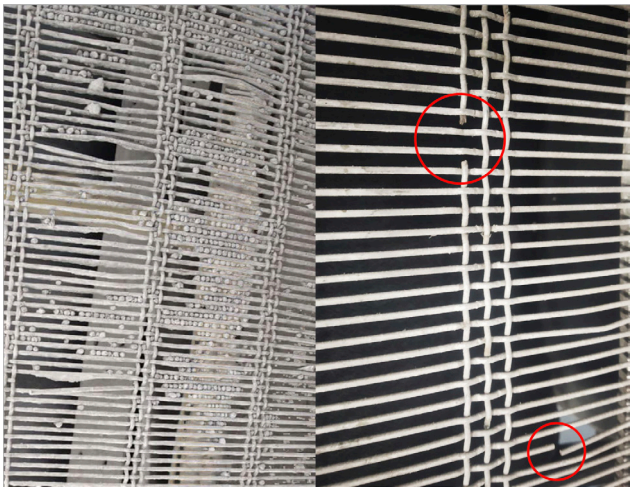

Figure 3. Damaged screen mesh from manual cleaning.

Selection of the wire mesh is critical to achieving maximum screening efficiency. Wire mesh opening, wire diameters, weave type, and materials of construction all play a vital role in screen performance. It is important to note that the effective wire mesh opening is smaller than the actual wire mesh opening due to the vibration amplitude and the wire mesh operating angle. Effective opening should be considered prior to wire mesh selection. Additional factors for maximising efficiency include uniform vibration amplitude, which is contingent on consistent tensioning of the wire mesh.

Mesh blinding: An inherent characteristic

Blinding occurs when individual, near-size material particles settle and become lodged in the wire mesh opening, preventing other particles from passing through (Figure 2). Although high frequency incline screens are designed to minimise mesh blinding, it is not completely avoidable given that blinding is a natural and inevitable result of screening product with a distributed size range. Several main factors attribute to blinding, such as:

- Type of material.
- Moisture content.
- Particle shape.
- Percent amount of near-size, on-size, fines, and over-size product.

Screens that experience wire mesh blinding suffer from reduced efficiency which impacts capacity, process control, and finished product quality. Periodic sieve analysis is recommended to monitor moisture, feed quality, size, and shape for reduction of blinding.

Managing blinding: Manual vs automated cleaning

Because blinding is a result of near-size material becoming trapped in mesh openings, it must be removed in order to optimise screening efficiency. Traditionally, lodged particles are removed manually which has several disadvantages including extended downtime and required cleaning personnel. Manual cleaning can also damage wire mesh by enlarging openings, stressing the wire which creates a concave zone where vibration is minimised, and deterioration of wire integrity (Figure 3).

J&H Equipment screening machines utilise an automated electronic cleaning system to mitigate blinding effects. This noninvasive cleaning system allows for uninterrupted production and extended wire media life.

Understanding the basics of variable frequency drive

A variable frequency drive (VFD) is a type of motor controller that operates an electric motor by varying the supply frequency and voltage. The VFD has many programmable functions, including cycle interval and duration, ramp-up acceleration, and ramp-down deceleration during start/top. The frequency (or operating Hertz) is directly related to the RPM of a motor. As frequency is increased, RPM increases. Today's VFD models offer broad control options, including integrated networking and diagnostics.

Generally, VFDs are used for control of equipment such as fans, compressors, and pumps.

Automated electronic cleaning and its benefits

A VFD can be used in sequence with the screen vibrator motors, and is programmed to briefly alter the operating frequency of the screening machine's electric rotary vibrators, resulting in increased RPM and vibratory action observed in the wire mesh. The alteration of vibration amplitude dislodges trapped particles. Electronic wire mesh cleaners are programmable to activate at set intervals determined by the user (Figure 4).

At a normal operating frequency, the wire mesh has a consistent amplitude from vibration. This consistent amplitude establishes an effective opening for passing material along with a constant wire tension. When the frequency is varied, it can increase amplitude, altering effective mesh opening along with wire tension and resulting in the dislodging of trapped material. Implementation of an automated cleaning system can offer reduced production downtime, lower maintenance costs, improved process control, and improved product yield/efficiency, resulting in increased margins (Figure 5).

There are several design details, constraints, and variables that should be considered depending upon application. It is important to have an expert in this field design a system optimal for your specific needs. VFD types, sequence parameters, cycles, durations, frequencies, and harmonics, among others, are points of understanding necessary for success and desired performance.

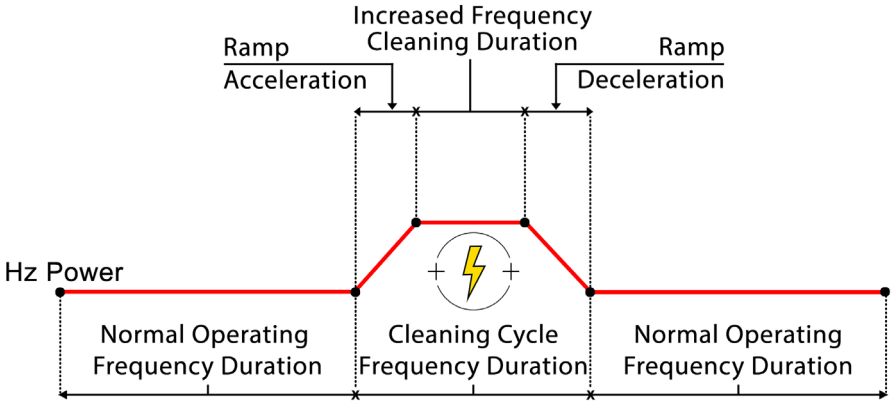

Figure 4. Automated electronic cleaning cycle representation.

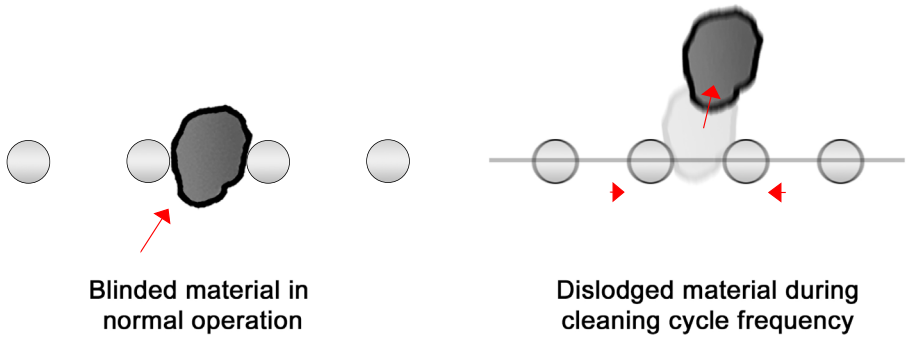

Figure 5. Non-invasive dislodging of trapped material.

Conclusion

The electronic cleaning system is an integrated control system utilising a VFD, designed to increase efficiency, optimise throughput, and reduce operating costs for fertilizer processing plants that use high frequency incline screening machines. The main function of the electronic cleaning system is to noninvasively reduce the amount of material lodged in wire cloth openings, which prevents material from being screened properly. Although there is an initial investment for the implementation of an electronic cleaning system, the benefits far outweigh the investment over time. Implementing an 'electronic cleaning system' can reduce maintenance downtime and cost, reduce the intervals at which cleanings are required, increase the efficiency of the screening machine, and extend the life of the wire cloth. WF