Bucket Elevators: 5 Factors to Consider for Trouble-Free Feeding and Operation

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Commonly used in many production processes to vertically lift bulk solids, continuous bucket elevators are a key conveying technology that many facilities depend upon for efficient material handling.

An aspect often overlooked with continuous bucket elevators is the need to consider how material is fed into the unit. As an equipment type, bucket elevators require a controlled infeed of material to operate effectively. Failing to consider how material will be presented to the conveyor can result in lost throughput, product degradation, and equipment damage and downtime.

This article presents five factors that should be considered and addressed to ensure that any continuous bucket elevator is properly fed with material and operated effectively.

TipTrak conveyor handling biomass pellets

#1: Consider the Method of Infeed Control Required

Bucket elevators can receive material from a variety of upstream process equipment, including mixers, blenders, dryers, pastillators, etc. Irrespective of the equipment type, it is critical to evaluate how the flow of material will be regulated as it enters the elevator infeed. To perform effectively, bucket elevators require a uniform and consistent rate of feed.

In some installations, the need for a regulated flow of material into the elevator is overlooked entirely. For example, we have seen installations where a bucket elevator was being fed directly from a bulk bag (FIBC) discharger without the use of any control device to regulate the flow of incoming material. Feeding an elevator with an unregulated flow of material can result in the following:

- Lost product and throughput. An unregulated flow of material is likely to overfill the buckets, causing product spillage. This wastes material and degrades throughput.
- Increased risk of an equipment jam or malfunction. Spilled product which is sticky and cohesive may accumulate and harden within the infeed section of the elevator, causing the conveyor to eventually jam. Similarly, buckets overfilled with heavy material, or overfilled with product that tends to interlock, may cause the machine to jam should it inadvertently be started under load.
- Increased risk of damage to elevator buckets and drive components. Dropping a large and uncontrolled headload of material into the elevator infeed can cause impact damage to the buckets and drive assembly components.

To avoid these problems, it is necessary to use an appropriate control or metering device, such as a vibratory or rotary valve feeder, to ensure a regulated flow of material into the elevator. The choice of which type of control device to use depends largely upon the application which the elevator is servicing.

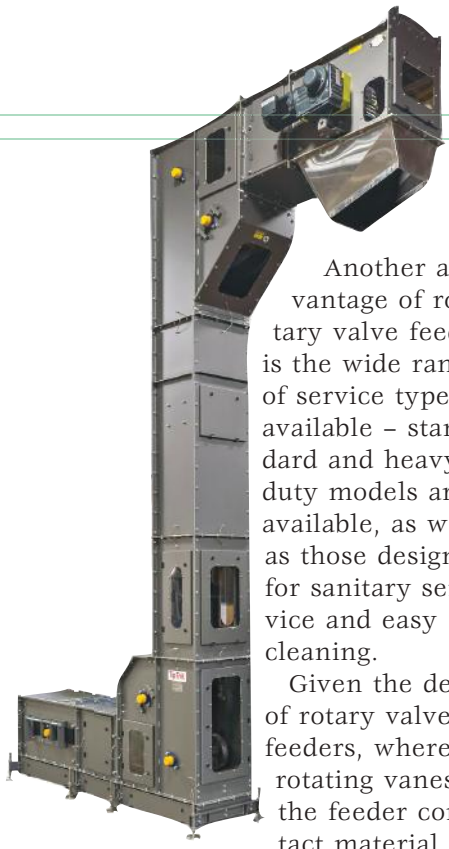
Vibratory feeders use vibration to feed material into the bucket elevator. The amplitude and frequency of vibration, together with the feeder's angle of deflection, serve to move a regulated amount of material into the elevator.

Vibratory feeders work well for many material types, especially those that are characterized as fragile or difficult-to-handle. Unlike rotary valve feeders, the design of vibratory feeders allows for a controlled flow rate without any degradation of the material moving through the feeder. Given their ability to control the flow rate with no material degradation, vibratory feeders are a preferred choice in high-care applications where product degradation must be avoided.

A second advantage of vibratory feeders is their consistent feed rates. Due to their design, vibratory feeders avoid the pulsed feeding of material that can result from using a rotary valve feeder. Vibratory feeders are available in fully enclosed tray designs for dust containment or to protect the product from external contamination.

Rotary valve feeders consist of a housing barrel containing evenly-spaced rotating vanes which contact incoming material and move it through the feeder. In applications which use a bucket elevator, a rotary valve feeder can be used as a volumetric feeder to discharge bulk solid material from a hopper or bin directly into the elevator infeed.

As with vibratory feeders, rotary valve feeders offer a fully enclosed feeding solution. This reduces the risk of material cross-contamination that can occur with release of dust into the ambient environment. Rotary valves are also used as an air-lock, suitable for purged systems or used as an isolation device when handling potentially explosive materials.



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Another advantage of rotary valve feeders is the wide range of service types available – standard and heavy-duty models are available, as well as those designed for sanitary service and easy cleaning.

Given the design of rotary valve feeders, where the rotating vanes of the feeder contact material and move it forward, there is an increased risk of product degradation when fragile materials are being transferred. Thus, rotary valve feeders are often best used in applications involving non-fragile materials. In addition, while rotary valve feeders can achieve consistent feed rates, the rotating vane design can result in a pulsed flow as the evenly-spaced vanes move material through the feeder into the conveyor.

When using a rotary valve feeder, it is preferred to orient the feeder's rotational axis to be at 90 degrees to the direction of travel of the buckets. This will ensure an even distribution of material within each bucket.

#2: Consider the Infeed Orientation

For continuous bucket elevators, it is preferred to feed material "in line" to the elevator infeed as opposed to, for example, feeding at right angles to the elevator infeed. Feeding material inline to the elevator infeed permits a more even distribution of material across the width of the buckets. In contrast, feeding the elevator perpendicularly can result in uneven material distribution within the buckets, as well as causing increased bucket wear that results from the more concentrated impact of material. The latter point is a particularly important consideration when moving abrasive materials or heavy products through the elevator. This can be resolved by incorporating abias cut to either the transition chute, or vibratory feeder tray.

#3: Consider the Material Drop Height

Minimizing the height from which material is dropped into the elevator reduces product

Standard infeed hopper with vibratory feeder

dusting and allows for a gentler transfer of material. Ensuring a gentle transfer minimizes particle attrition and is important when handling fragile or friable materials that could degrade when dropped into elevator from too high a height. In addition, minimizing the material drop height reduces impact wear on the buckets, reducing the need for maintenance interventions and replacement parts.

#4: Consider the Equipment Start-Up Sequencing

To ensure that no load is present at start-up, the elevator should be started and allowed to "ramp up" to the desired operating speed before being fed with material. This can be accomplished by setting an appropriate time delay on the control device used to regulate the flow of material into the elevator infeed. The time delay ensures that no material enters the elevator until the operating speed is reached, avoiding any potential damage to the conveyor.

TipTrak infeed from screener upstream

#5: Consider the Need for Any Transition Chutes

Transition chutes contain and direct material as it transfers from an upstream process into the elevator infeed. Material containment is particularly important when handling hazardous or toxic materials, which usually require fully enclosed connections. These sealed connections would be made either using a direct "flanged" or a "flexible" type. Transition chutes should be designed with a geometry and size that allows for a controlled and even flow of material through the chute and into the elevator.

When buying and installing a continuous bucket elevator, be sure to discuss with the equipment manufacturer all aspects of how the unit will be fed. Addressing the factors described above will ensure that the elevator is uniformly fed with material and help avoid performance problems that can result from improper feeding.

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