

Bucket Conveyors: Frequently Asked Questions

By James Bransfield, UniTrak Corporation Ltd

Bucket conveyors are used quite frequently in many bulk material conveying applications. However, many aspects of bucket conveyor design, features, and performance are not always well understood in the marketplace. Here are some frequently asked questions and answers about these types of conveyors.

Q: What is the difference between a bucket conveyor and a bucket elevator?

A: Although the terms “bucket conveyor” and “bucket elevator” are often used interchangeably, there are some subtle differences in meaning. The term “bucket elevator” is the more traditional and perhaps more frequently used term. It is often used to refer to vertical conveyors that are used in agricultural and farm applications to move grain and other bulk commodities.

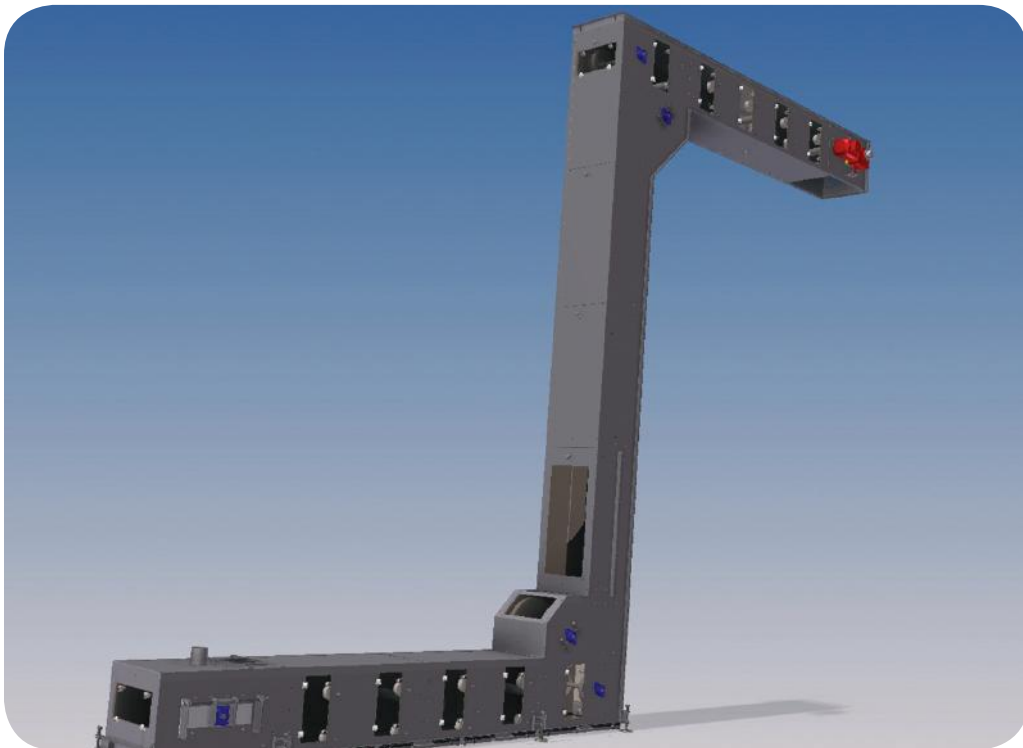


Figure 1: Z-Type bucket conveyors are frequently used to traverse long horizontals, as well as vertical elevations.

Bucket elevators typically scoop product up with rapidly moving fixed buckets and discharge the material using centrifugal force. Bucket conveyors, in contrast, are positive discharge conveyors, where the buckets are held in an upright position and discharged using mechanical or other means. Bucket conveyors are typically used in situations where the gentle handling of product is a primary concern.

Q: What are the size limitations of a bucket conveyor?

A: Theoretically, a bucket conveyor of almost any size could be constructed. Practically, however, there are limits on the heights and lengths that are achievable with current technologies. In many applications, the objective is to achieve your vertical conveying requirements while using the least amount of floor space.

Equipment height, or discharge elevation, can vary by manufacturer. For example, we have made bucket conveyors with discharge elevations of 120 ft, and it is possible to go higher with tandem belting. However, for many applications, discharge elevations in the range of 8 to 40 ft are more typical. Z-type bucket conveyors are frequently used to transverse long horizontals when it is desirable to avoid a transfer to another piece of equipment, or where space is too limited to allow for another horizontal conveyor.

Q: What are the power requirements of a bucket conveyor?

A: One of the major advantages to bucket conveyors is the lower power requirements of the equipment. With the weight of a loaded bucket assembly on either side of the vertical elevation of the conveyor being equal, the system is in balance. The only power required is that needed to overcome the inertia of the system and the weight of the material being lifted. Consequently, well-designed bucket conveyors can be operated with relative low energy requirements.



Figure 2: One way of controlling the infeed into a bucket conveyor is the use of vibratory feeders, which eliminate changes or surges that could cause the buckets to overfill.

Q: How should a bucket conveyor be fed with material?

A: As with any conveyor, accurate infeed control is critical to ensure successful material handling when the conveyor is operating.

Material should be delivered to the bucket conveyor in a uniform or metered fashion – this prevents any sudden increase in the amount of product being introduced into the conveyor. Any dramatic changes or surges in input ma-

terial can cause the buckets to overfill, causing material spillage. Often, vibratory feeders, screw conveyors, belt conveyors, and rotary valves are used to deliver material to a bucket conveyor in a uniform and consistent manner.

Q: Is it preferred to feed a bucket conveyor from the side or from the end?

A: Usually, material can be fed into a bucket conveyor from the side, end, or from directly above the buckets. In most cases, feeding in-line with the buckets achieves a more uniform distribution of material within the buckets. Feeding from the side, however, seems to be a more common method. Using this method may result in material piling up within the middle of the buckets. This problem may be alleviated by using a bias cut feeding pan or chute.

Q: Are bucket conveyors suitable for outdoor applications?

A: Bucket elevators are suitable for use outdoors. Typically, bucket conveyors for outdoor applications use stainless steel fasteners to prevent corrosion and rusting, and are often fully enclosed to protect the internal components.

Q: How much material can a bucket conveyor handle?

A: The capacity (or more properly, capacity rate) of a bucket conveyor defines

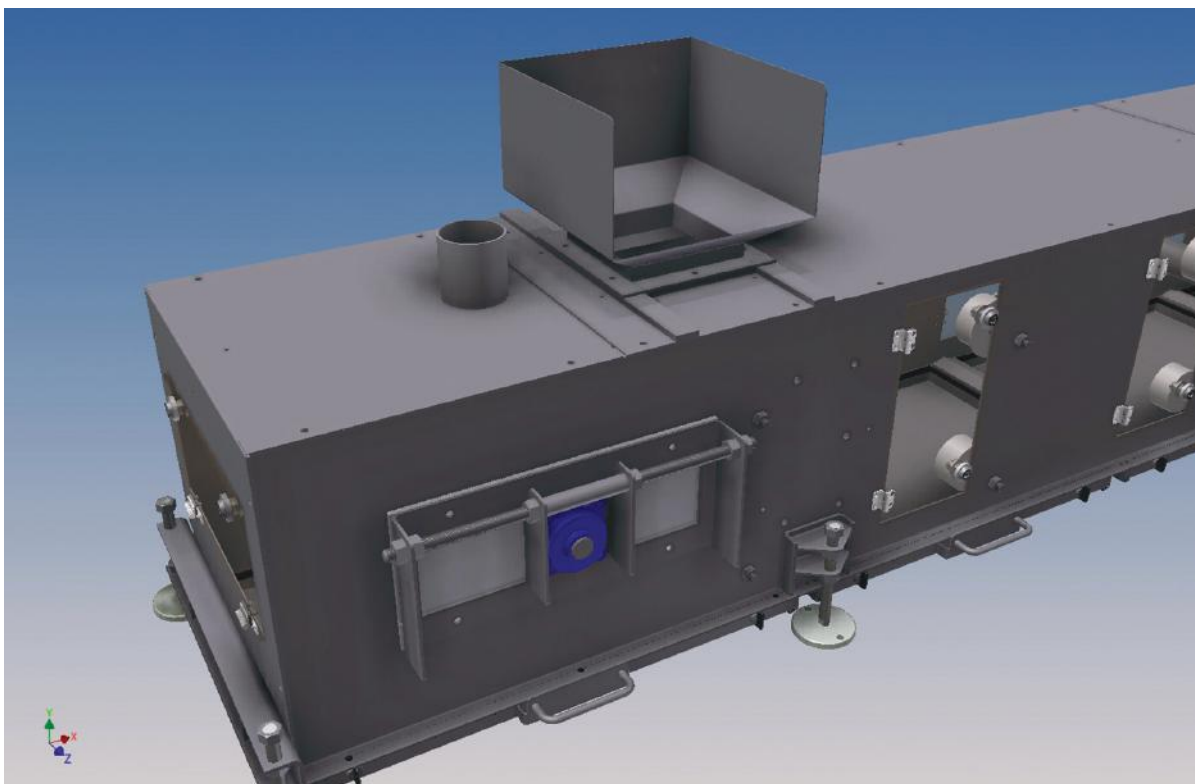


Figure 3: A common method of feeding the conveyor is from the side of the unit. Custom infeed chutes can be used to ensure material doesn't pile up in the middle of the buckets.

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the quantity of material that the equipment will convey. Bucket conveyor capacity, or capacity rate, is synonymous with throughput rate. The capacity of any particular equipment design is usually a function of bucket size, number of buckets per foot, and the unit operating speed. Bucket conveyor capacity is usually expressed as the maximum throughput achievable, given a bucket fill percentage and unit operating speed.

Q: Can a bucket conveyor be stopped and started when it is fully loaded with material?

A: Yes. Most bucket conveyors can be stopped and started when fully loaded with material. However, anti-rollback devices are required as a safety feature to prevent full buckets from travelling backwards when the conveyor is stopped.

Q: How easy is it to clean a bucket conveyor?

Cleaning of a bucket conveyor can be a significant issue in many applications. These types of applications are most commonly found in the food industries, such as snack food, vegetable and fruit processing, confectionery, pet food, and others.

In applications where the cleaning of a bucket conveyor is an essential activity, using equipment of an open frame/tubular design is preferred. The tubular design allows cleaning fluids to reach all operating components and dissolve any accumulated material. Equipment with an open/tubular design also allows for faster drying times.

Where it is not practical to use equipment of an open frame/tubular design, a bucket conveyor may be cleaned using a variety wet or dry cleaning methods, such as hand-wiping buckets, spraying the unit with hot water or steam, or using compressed air or vacuum suction. Each of these methods has its own advantages and disadvantages.

Increasingly, Clean-In-Place (CIP) systems are being used on bucket conveyors for sanitary wash-down applications. These require minimal operator involvement, can be made to run automatically, and may be used with foaming cleaners. A disadvantage is that they do not permit the continuous inspection of the cleaning effectiveness.

Q: Can a bucket conveyor be used in hazardous or explosive applications and environments?

A: In some applications, the risk of an explosion is real when the material being conveyed has a propensity to give off fine dust. In such conditions, the presence of a spark or flame can lead to a dust explosion. The consequences of such explosions can be severe, even catastrophic, resulting in possible loss of life and significant facility damage.

In applications where the risk of explosion is real, a fully enclosed bucket conveyor outfitted with explosion-proof options and compliant to European ATEX or similar North American directives should be employed. Key equipment features to look for include the following:

- Fully enclosed or open designs may be employed. A fully enclosed design has the advantage of being completely dust-tight. These units have gasketing between sections and around all access doors to ensure dust-tight operation.



Figure 4: Risk of dust explosion can be mitigated in Z-type bucket conveyors. Fully enclosed and open constructions have several options to ensure safe conveying.

- Explosion-proof motors and complete grounding of the electrical system, including speed sensors and ionizer assemblies, to dissipate any electrical charge buildup

- The provision of conductive bucket assemblies, such as those with static-proof plastic buckets and joint strips, and a rubber belt drive, will prevent the accumulation of static charges.

- Unpainted pulleys and shafts to ensure a completely conductive path to ground

- Conductive grease in bearings to dissipate any static charge buildup

- Ground straps and grounding wire provided through the entire frame assembly to ensure a fully conductive path to earth

- Ability to operate under a nitrogen purge to eliminate the accumulation of any explosive atmosphere within the machine

- No interior ledges on which explosive dust can accumulate



Figure 5: Z-type bucket conveyors require regular maintenance, such as cleaning, but does not need lubrication or tensioning like a continuous or centrifugal bucket elevator.

Q: What are the typical maintenance requirements for a bucket conveyor?

A: Cleaning, lubrication, and tensioning are maintenance activities that are usually required on most bucket conveyors. Although the operating environments and the material being handled can vary significantly, cleaning of the conveyor is usually the most crucial maintenance activity. Unless the accumulation of fines is cleaned out periodically, these accumulations can lead to serious problems such as damaged buckets, or even a catastrophic failure of the drive chain.

Lubrication and tensioning requirements depend on the particular design of the bucket conveyor being used. Most positive discharge bucket conveyors use a metal roller chain to lift and suspend the buckets. Such chains require periodic lubrication and tensioning. Other bucket conveyor designs use a molded rubber chain, internally reinforced with stainless steel cables, which does not require any lubrication or tensioning. Most bucket conveyors use bearings to support the main sprockets or pulleys, which require lubrication depending on the duty and exposed environment.

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