



White Paper

Industry Report: Conveying Fresh-Cut Produce

Many fresh-cut produce processors and packers have traditionally relied on belt conveyors to transport bulk and packaged product on their production lines, in part because low capital costs make these conveyors seem so affordable. But when ongoing maintenance and sanitation costs are factored in, the affordability equation shifts in favor of other conveyor types. Add performance issues like gentle handling and throughput into the analysis and each fresh-cut product and application points to its own ideal conveying solution.

In this white paper, we will explore the types of conveyor systems that are suitable for fresh-cut produce – belt conveyors, vibratory conveyors, and horizontal motion conveyors – highlighting the strengths and weaknesses of each. We will consider a variety of fresh-cut products from leafy greens to whole and cut fruits and vegetables as well as a range of applications from simple conveying to dewatering, fines removal, and more. The goal of this paper is to help fresh-cut processors and packers identify the most effective conveying solutions for their specific applications.

Belt Conveyors

Belt conveyors typically offer the lowest initial capital cost of all the conveying solutions, which contributes greatly to their popularity. But such a simple cost analysis is shortsighted because high maintenance and sanitation costs cause the total cost of ownership of a belt conveyor to quickly rise.

Although the initial price tag for vibratory conveyors and horizontal motion conveyors is often significantly higher than belt conveyors, that higher upfront cost is quickly recouped due to lower maintenance costs. Keep a conveyor in operation for more than three years, and the vibratory or horizontal motion shakers usually cost less.

Although a total cost of ownership analysis indicates that vibratory and horizontal motion conveyors are less expensive than belt conveyors in the long run, there are fresh-cut applications that are best served with belt conveyors, warranting their use despite the higher cost.



These applications include the following:

- Belt conveyors are ideal for achieving significant changes in elevation. Vibratory shakers are effective if the required incline angle is 10 degrees or less but beyond 10 degrees, a belt conveyor is needed.
- Layering belts where incoming product is loaded either manually or automatically are best accomplished with belt conveyors because of the slow rate of movement – typically 3 to 4 feet per minute – which is needed to achieve a well-mixed product.
- Trim tables can be served with either belt conveyors or vibratory shakers. Belts are sometimes preferred because they offer the most flexibility in speed.
- Two-level storage conveyors that convey fresh-cut produce from a washer to a dryer are belt conveyors for two reasons. First, there is usually a significant rise in elevation. Also, a belt conveyor can easily move both forward and backward, which allows the two-level storage belt to transition product to the lower level if the dryer is mid-cycle and then bring that product from the lower level back when the dryer is available for loading.
- Conveying packaged product can be achieved effectively with either a belt conveyor or a vibratory shaker. The sanitation advantage of a vibratory shaker is less of a factor with packaged product, making a belt conveyor appropriate here.

Vibratory Shakers

The goal of the multihead weigher is to deliver product charges to the FFS machine at the ideal weight and at a speed that allows the FFS machine to maximize its output while achieving the perfect separation between product charges for the FFS machine's jaws to seal properly. The scale is a "slave" to the FFS machine.

The speed of the FFS machine, the weight and volume of the product to be packaged, along with other physical characteristics of the product are factors used to determine the ideal multihead weigher for the application. The number of buckets, the size of the buckets, and the configuration of the chutes may vary dramatically from one application to another.

Ideally, the speed of the scale should be set slightly faster than the speed of the FFS machine so the FFS machine is never starved for product. The FFS machine will provide a signal to the multihead weigher when it is ready to accept the next product charge. Typically, a 100 millisecond separation between the trailing edge of one product charge to the leading edge of the next charge is sufficient regardless of the dwell time needed to achieve a good seal.

The multihead weigher is also known as a combination radial weigher. The weigher will use multiple buckets in a combination to achieve the total target weight desired. For example, if the desired target weight is 100 grams, the scale will choose multiple buckets

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that combined will equal 100grams. Typically, the scale chooses between 3 to 5 buckets in combination. The computer on the scale is constantly looking at individual bucket weights in search of the perfect combination.

Overfeeding the multihead weigher by delivering too much product results in fewer available bucket combinations within the scale. This affects the weigher's ability to hit the

perfect total weight of the charge, which hurts weighing accuracy. Underfeeding the scale requires more buckets in a combination to achieve the total weight, which hurts the speed of the system since the buckets will need time to refill before being available again. Both speed and accuracy of the packaging line will affect the production yield and ultimately, the bottom line.

In general, better speed and weighing accuracy is achieved with a multihead weigher that features more buckets because there are more potential combinations available to achieve the perfect total charge weight. However, higher capital costs associated with a larger scale force most food processors to consider the trade-offs, select a scale that achieves the optimal balance, and then focus on maximizing the effectiveness of the equipment.

For these reasons, feeding the scale at the proper rate has a direct effect on the efficiency of the scale and thus, the output of FFS machine. Infeed rings, infeed funnels, and linear feed pan designs help present a constant waterfall of product to each bucket. Yet it's the relationship between the weigher and the upstream scale feed shaker that ultimately controls the flow of product to the scale. The better the integration between the weigher and the scale feed shaker, the better the FFS machine's output.

Horizontal Motion Shakers

Like vibratory conveyors, horizontal motion conveyors offer more gentle production handling than belt conveyors and lower maintenance and sanitation requirements lead to a lower total cost of ownership than belt conveyors.

Horizontal motion conveyors provide gentle handling for delicate products that can slide on the conveyor bed without being damaged, such as whole mushrooms. Leafy greens, however, get scuffed and damaged by riding on the bed of a horizontal motion shaker so vibratory conveyors provide gentler handling for these types of products. Also, the slower conveying speed of horizontal motion sometimes encourages processors to run product deeper to get the throughput they need, and loading delicate products deep can cause damage.



Another significant difference between horizontal motion and natural frequency vibratory conveyors results from dynamic loading. Horizontal motion shakers create high dynamic loads during operation and require isolation via a separate deck, while vibratory shakers require no additional isolation and can be suspended from overhead, mounted to other machinery, or supported from the floor. Thus, horizontal motion conveyors have less installation flexibility and higher installation costs compared to vibratory conveyor systems.

Despite the general advantages of greater throughput, improved installation flexibility, and reduced installation costs that vibratory shakers have over horizontal motion shakers, there are specific applications in which horizontal shakers are ideal, including the following:



- Horizontal motion conveyors are perfect for some delicate products when high throughput is not important. In addition to whole mushrooms, whole potatoes, which bruise easily, are handled well with horizontal motion when they are not loaded too deep into the conveyor bed. This gentle handling advantage must be considered on a product-by-product basis because many seemingly delicate products such as blueberries are handled well with vibratory conveyors and other products like leafy greens are actually handled better with vibratory conveyors.
- For fresh-cut produce that is not delicate, especially products that have no flat sides to scuff along the bed of conveyor, like baby whole carrots, horizontal motion conveyors work well. For these products, the throughput that can be achieved with higher-speed vibratory shakers can be matched on horizontal motion shakers by increasing the depth of the product flow.
- Unlike vibratory conveyors, some horizontal motion conveyors can reverse product flow, which increases the flexibility of the line.
- Although the noise of a horizontal motion conveyor drive is similar to that of the traditional vibratory conveyor drive, some products such as baby whole carrots that would make a drumming noise on vibratory shakers will run more quietly on horizontal motion shakers. That said, electromagnetic drives are the most quiet of all, so if product drumming is not an issue, an electromagnetic vibratory shaker will be the quietest solution.

- Because horizontal motion conveyors can be heavily loaded, they provide some bulk storage capacity on the production line when conveying product in which gentle handling is not important.

Conclusion

To select the ideal conveyor for each situation, fresh-cut processors and packers should take into account a wide variety of factors from costs to performance issues.

To determine the total cost of the conveyor system, start with the initial capital cost plus the cost of installation and add the projected annual maintenance and sanitation costs over the anticipated life of the equipment. Such a long-term view highlights the relative affordability of vibratory and horizontal motion shakers over belt conveyors.

Beyond costs, the strengths and weaknesses of each conveyor type should be considered as well as the specific applications in which one particular type of conveyor excels. Some delicate products such as leafy greens are gently handled with vibratory conveyors while other delicate products such as whole potatoes are handled well with horizontal motion conveyors. The benefits each type of conveyor must be judged on a product-by-product basis.

To help navigate this complicated analysis, processors and packers should consider working with an equipment supplier that offers expertise in the fresh-cut industry and provides a full range of conveying solutions to choose from. With a deep and broad knowledge base, such a supplier can be a valuable resource in identifying the ideal conveying solutions that create competitive advantages by improving the performance on the production line. Because, if designed properly, conveyors can do much more than simply move product throughout the plant. Gentle handling, effective dewatering, and chilling, to cite just a few examples, can improve product quality and extend shelf life.

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Key Technology, Inc.
150 Avery Street
Walla Walla, WA 99362

☎ 509.529.2161
✉ product.info@key.net
www.key.net